

NOV 17 1947

# Electrical Construction and Maintenance

*With which is consolidated* ELECTRICAL CONTRACTING

NOVEMBER · 1947

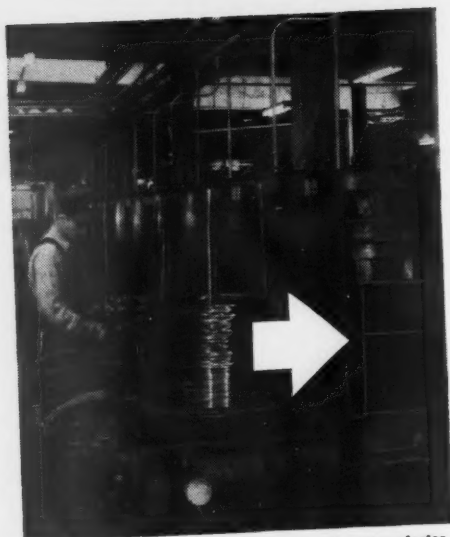
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## *In This Issue*

A MCGRAW-HILL PUBLICATION





G-E Pyranol capacitor on load side of motor starter at Union Wire Rope Company

## How Kansas City Firm BOOSTED FEEDER CAPACITY 31% without installing new copper

The Union Wire Rope Corporation of Kansas City, Mo., needed to install more machinery to increase production. The plant's 2600-kva of transformers and feeders were fully loaded. But—a lot of the load was in kilovars (reactive kva) used by induction motors on the circuits.

### Producing Kilovars at Motors Was the Answer

So Union, rather than replace feeders, began to install G-E capacitors. These are connected to motor starters—produce the needed kilovars on the spot, for each individual motor. Installation has been gradual—a 5-kvar capacitor here, a 10-kvar

unit there—until today 1245 kilovars are supplied right at the motors. Relieved of this non-productive load, the original feeders are delivering almost a third more power, to additional machines.

### New Motors, Too, Will Have Capacitors

While power factor at Union is now good (95 per cent against the original 68) each new motor will have a capacitor installed with it. It pays—in reduced size of new feeders, transformers, and switching equipment, in better motor voltage, and in lower distribution losses.

### CAPACITORS MAY MAKE SIMILAR SAVINGS FOR YOU

If you need additional power from fully loaded circuits or transformers, investigate capacitors. If you are having troubles because of low voltages, capacitors may be your answer. And, if you have a penalty clause in your power contract—power factor, kva demand, or kilovar—capacitors will almost certainly save you money.

In any of these cases, a General Electric engineer will be glad to work with you in determining how capacitors can help you, and just how much they will save. Just call your G-E representative, or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

### Recommended maximum rating (in kvar) for capacitor connected to load side of induction-motor starters.

MOTOR RPM	INDUCTION MOTOR HORSEPOWER RATING													
	10	15	20	25	30	40	50	60	75	100	125	150	200	
3600	2.5	2.5	5	5	7.5	10	12.5	15	17.5	22.5	25	32.5	42.5	
1800	4	5	5	7.5	10	10	12.5	15	17.5	22.5	27.5	35	42.5	
1200	4	5	5	7.5	10	10	12.5	15	17.5	22.5	27.5	35	42.5	
900	5	7.5	7.5	10	10	12.5	15	17.5	20	25	30	37.5	45	
720	5	7.5	10	10	12.5	15	20	22.5	27.5	35	40	47.5	60	
600	7.5	10	12.5	15	15	17.5	22.5	25	30	37.5	47.5	55	67.5	

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# Electrical Construction and Maintenance

With which is consolidated *Electrical Contracting*,  
*The Electragist* and *Electrical Record* . . . Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

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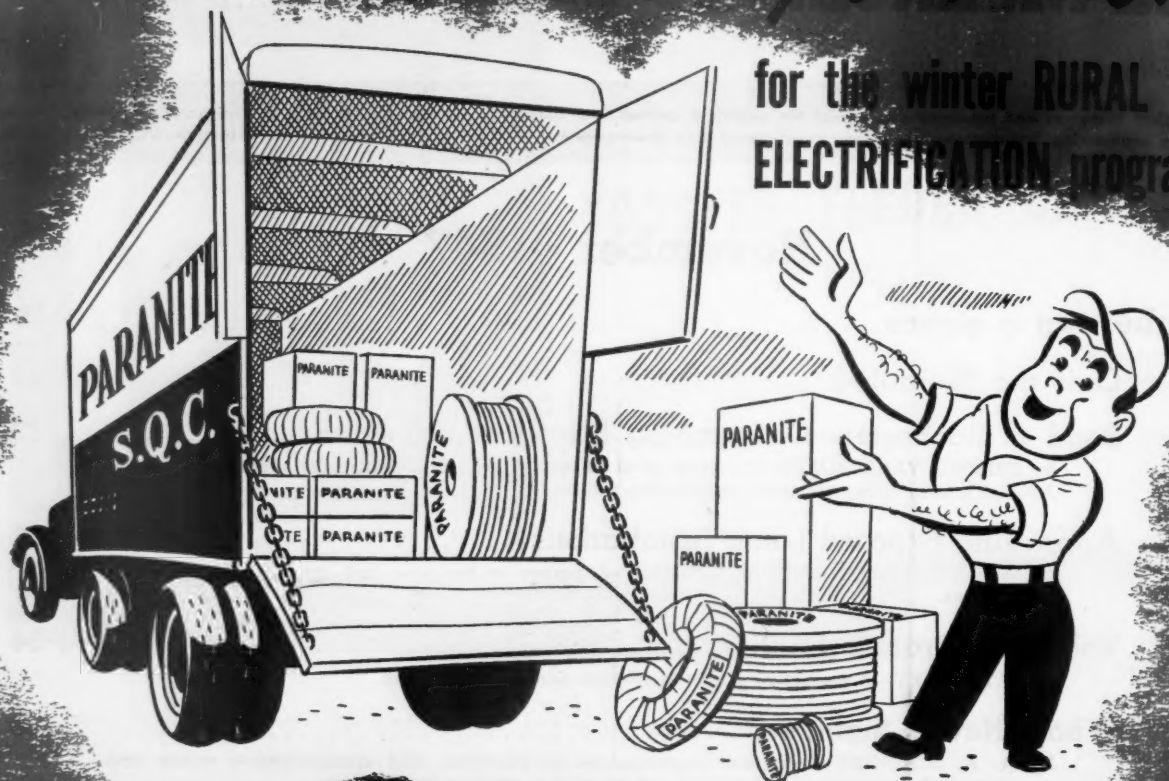
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# NOVEMBER . . . at a Glance

## Plain Talk

Back in the early days of sound paging systems, speakers were loud. If they couldn't penetrate 100 feet of machine shop din, they were considered a waste of money. It didn't make too much difference if fidelity was good or bad so long as an intelligible syllable or two came through. Fortunately, this monstrous approach to sound system design is past. But the bad practices linger in even some modern installations. The ability of modern equipment to handle plain speech with excellent fidelity even at high volume levels is unquestioned. But 50 watts of plain talk at ten paces leaves the listener far too busy keeping his bones assembled to pay much attention to the intelligence conveyed. A number of small speakers operating at low volume dispersed generously over the area to be covered can reach individuals far more quickly and with less disturbance.

## Lighting Data

Reprints of the 28 page manual of useful data for lighting system layout and design which appeared as an editorial feature section in last month's issue are still available, but going fast. If you want additional copies for reference and office use, get your order in as early as possible. Single copies are 35 cents. Ten or more 30 cents each. We shall be glad to quote on larger quantities. Address inquiries to the Editorial Department.

## Job Duration

Turnover is a vital factor in merchandising. In construction work we have some of the same problems on a vastly more complex scale. What costs are incurred by projects extending beyond estimated duration, for instance? How can these costs be estimated and appraised? In his

series on Volume-Duration Studies, of which Part 3 appears on page 54 in this issue, Ray Ashley has developed the answers. These data are unique in our experience and are a very important contribution to our understanding of job costs.

## Outstanding Job

Big electrical construction projects are often a maze of wiring and equipment details that contains useful methods and ideas. The usual three and four page article is too cramped to give these outstanding projects the detailed treatment they deserve. In this issue, page 43, we are trying out a new editorial technique in the first of a series of stories about outstanding electrical construction projects. You will note first a much more generous use of space, nine pages. General job description is limited to one page. Each spread thereafter is a compact separate article about one specific phase of the work. Illustrations, diagrams, portions of plans and photos carry the burden of the story, text is short and concise. Another innovation is the list of materials, their manufacturer and wholesalers. On projects of this scope materials procurement is a major undertaking in these times. Materials sources are not only pertinent to good reporting, but also provide a quick and accurate measure of quality.

## Lighting Awards

Winners of gold seal merit awards in the lighting competition held in connection with the 2nd International Lighting Exposition in the Electrical Contractor classification were George W. Phelps, Boston, E. J. White, Edward J. White Co., Newark, N. J. and Spott Electrical Company of Oakland, California. Of 183 merit awards, 21 went to electrical contractors. Every one of them deserves our heartiest congratulations. They have brought distinction and honor not only to themselves, but to the industry they represent.

## Bare Lamps

As a general rule, lighting men consider exposed lamp installations poor illumination practice. The subject is highly controversial. The fact remains, however, that many small store owners prefer their lighting "straight" and insist on exposed lamp installations whether lighting experts approve or not. And so long as there are customers who want exposed lamp systems, they are going to be served. Given the job of installing such systems, lighting men still have the responsibility to know under what conditions they are most likely to be successful, the things to do and the practices to avoid. We posed the problem to Ward Harrison and J. L. Tugman of Nela Park. They came back with a down-to-earth appraisal. You'll find it on page 52.

## High Voltage

When loads run upwards of 1000 kva., primary voltage service and distribution is becoming almost commonplace. Modern metalclad unit substations are compact, economical and safe in industrial surroundings. With primary and secondary networks such systems are practically immune from shutdown. Consequently, electrical contractors and industrial electrical departments are installing and maintaining a lot more high voltage equipment than ever before, activity that requires a high order of skill and understanding. Once the almost exclusive province of utility distribution departments, high voltages are now frequently encountered in industrial and even commercial wiring installations. The trend is important. Any great strides in electrical utilization are bound to bring loads which can be more economically handled at higher voltages. Organizations and men experienced, skilled and competent to handle high voltage wiring and apparatus are vitally essential to such progress.



Dear Sir:

June 15, 1947.  
Springfield, Ohio.

I'm an apprentice electrician and I've had several occasions when I've wondered what the different types of wire were and what the advantage was of using one type in preference to another. There are so many different types. I've asked several journeymen what the advantages were and why some were rated at a higher amperage than others of the same gage. So I thought I'd write and see if you could give me some information on the subject. No one else can or will as the case may be. I'd greatly appreciate any information that is available. I've noticed that so many use different types without knowing why. I'm especially interested in the various "T" types

Sincerely yours

J. K. S.  
249

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NOVEMBER, 1947

# ONLY THE BEGINNING

CRITICAL APPRAISAL of the winners in the International Lighting Exposition competition in Chicago indicates that modern planned lighting is making strong headway. Of hundreds of entries a few showed great distinction and wound up in the money. Many others earned well deserved awards of merit. All honor to the winners. They have contributed to a great event that may well become one of the milestones of lighting progress.

EXAMINATION of the merit award lighting jobs can give us all a great deal to think about. They illustrate a tremendous variety of lighting methods; they employ widely different light sources, fixtures and layouts; almost all carry strong commendation from the customer. Yet, while we can feel pretty proud of all these examples of lighting progress, it is plainly apparent that this is only the beginning. Though we seem to have taken great strides, each new achievement broadens our horizons and sets up new goals.

PLANNED LIGHTING has broken through conventional practices of the past in several distinct bulges. First, emphasis is swinging to the solution of lighting problems, rather than the mechanics of producing light. Many of the installations shown in Chicago used symmetrical arrays of standard lighting fixtures, but with much more concern for surrounds, planned intensities, and brightness ratios. They bear out what we have often pointed out on these pages, that planned lighting is not necessarily custom built equipment, but the engineered application of lighting fixtures and components to the lighting task.

FURTHER, many of the installations show a new emphasis on "punch" lighting, the effective use of higher intensities in the presence of good general lighting. This area of lighting application is still relatively unexplored. As general lighting reaches higher intensities, it would seem that such applications would be less effective. The contrary is proving to be true, particularly in commercial lighting.

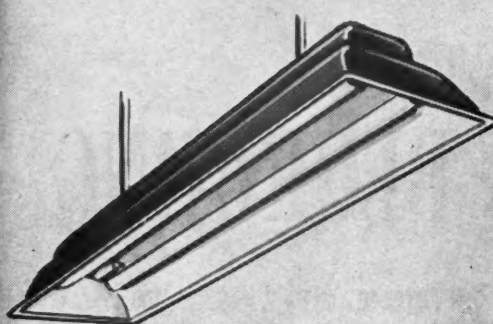
AMONG THE COMMERCIAL lighting installations there are many clear examples of lighting used as a major selling force. This has been foreseen as an important merchandising technique. It has been applied in display cases and show windows. Now it is showing up in store-wide application. We must not underestimate the importance of this development on all lighting. It is revolutionary in its implications. In it we see lighting going beyond its primary job of aiding vision to become a compelling psychological force as well.

WE HOPE that the Lighting Exposition competition will be repeated in the years ahead. It is a splendid opportunity to bring together for comparison and analysis new lighting applications from all parts of the country. By practical example it brings new strength and courage to sales efforts. It provides a base line for progress from here on. This is only the beginning. There are still greater achievements ahead.

*Wm. F. Stuart*



**For that  
lighting  
installation  
you're  
planning**



## Graybar's near-by office distributes them

At Graybar warehouses, strategically located throughout the nation, stocks of many kinds of G-E lamps are maintained for prompt, local delivery. Graybar distributes *all types* and *all sizes* of incandescent and fluorescent lamps for indoor, outdoor, and product lighting — plus germicidal, infra-red, and other special lamps. A Graybar Lamp Specialist will gladly help you determine the best type and wattage of lamp for any requirement.

Although all the lamps you want may not be available today, supplies are increasing, and we hope soon to be able to deliver any type of lamp — in any quantity — anywhere — on a moment's notice.

Whatever the lighting requirements, Graybar can impartially recommend the correct lighting equipment from the most complete selection of lamps and lighting units available from any one source. *Graybar Electric Company.*  
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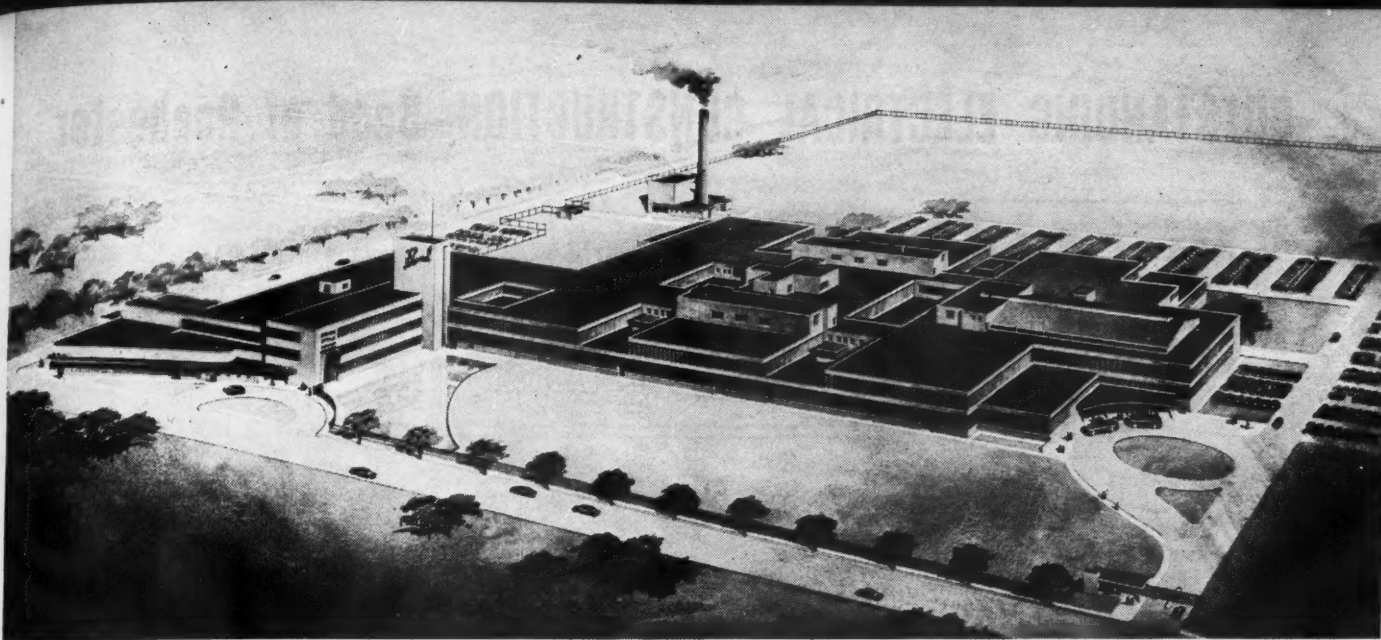
Whenever you need facts about one or several kinds of electrical equipment or supplies, call the near-by Graybar office. That's the quickest, easiest way to get the information you want. As distributor of the products of over 200 leading manufacturers, Graybar can give you catalog, price, and delivery information on over 60,000 electrical items. Graybar Specialists are prepared to supplement this information with sound recommendations on selection and application.



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# BOND... of ROCHESTER

**Style Manor—world's greatest clothing factory nearing completion at Rochester, New York, exemplifies modern electrical construction techniques. Primaries serve overhead substations at load centers linked by secondary network ties. Unique combination lighting fixture and power rail employed over cutting tables. A roundup of important electrical construction details on one of America's outstanding projects.**

**By Fredric Vanderlinde**  
*Vanderlinde Electric Corp.*

Many great projects started after the war are now approaching completion. Some are prewar jobs which were shelved for the duration. Others were planned and built entirely in the postwar era. In either case the practical trends of modern electrical construction are beginning to appear in actual work in place.

Great structures with electrical work and equipment running into seven figures are comparatively few in number. Yet by sheer size and complexity they pose problems in planning and execution that bear directly on management, methods, labor and materials of importance to all of us. And in the details of electrical work on one such project is a mine of useful data and methods for electrical men everywhere.

This article is the first of a continuing series of similar detailed studies of outstanding electrical construction jobs which will appear from time to time in these pages. We hope you will find them practical and useful. Obviously, in such huge jobs, we cannot give more than the highlights even on such a broad canvas as the nine pages devoted to this story. Your comments and suggestions as to how we can improve the usefulness of this type of story will be cordially welcomed by the editors—W. T. STUART.

**S**TYLE MANOR, the world's largest clothing plant will be turning out Bond's popular Rochester tailored clothes early in 1948. Electrical system capacity, including immediate connected load and provisions for foreseeable future requirements, totals 4400 kva.

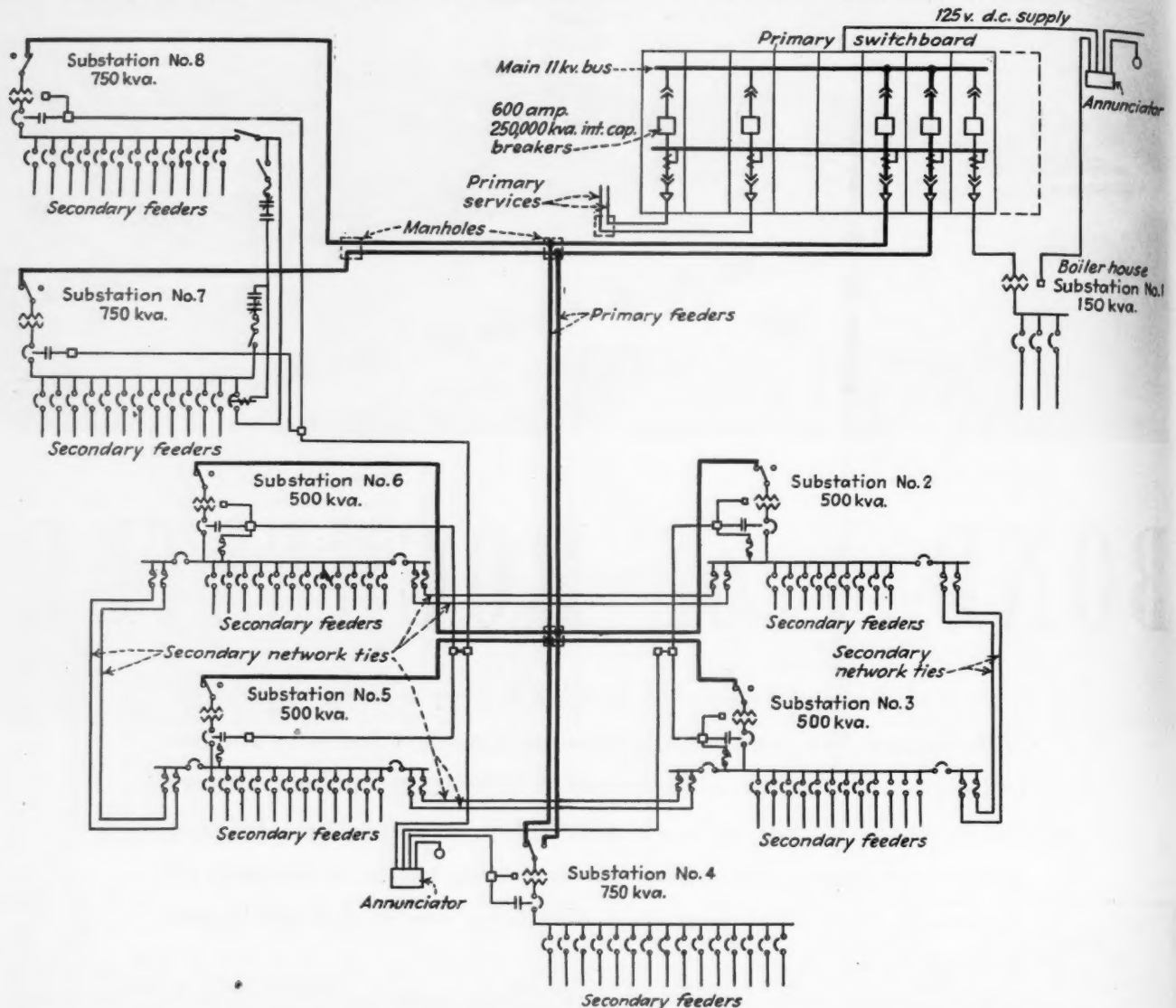
In line with modern industrial practice, power is distributed at primary voltage (11,400 volts) to strategically located unit substations. Modern network techniques provide insurance against shutdown from local power equipment failure. Facilities are provided for quick rerouting of primary feeders in the event of cable failures. Secondary distribution is planned for wide flexibility and ready adaptability to new department layouts.

The broad scope of the work and the many specialized problems encountered in the wiring system planning inspired many ingenious methods some of which are described in detail on the following pages.

In execution, the work required exceptional cooperation between owners, representatives, engineers, contractors and suppliers. Severe shortages of materials were a constant problem, but due to the fine job of teamwork it was never necessary to compromise with quality in either materials or workmanship.



# OUTSTANDING ELECTRICAL CONSTRUCTION—Bond of Rochester



Schematic diagram of high and low voltage distribution systems. Two primary feeders serve eight substations. Secondary networks link substations 7 and 8; 2, 3, 5 and 6. Primary feeders are 350 MCM. Primary voltage is 11,400 delta, secondary is 120/208 four wire. Substations 7 and 8 are linked automatically through secondary tie in event of primary failure. Others are linked manually.

## PRIMARY DISTRIBUTION

Energy is brought at 11,400 volts, 3 phase to the main switchboard on two Rochester Gas and Electric Corp. feeders. A portion of the main switchboard remains the property of the utility company and serves as a substation. The owner's section of the board consists of three feeder panels containing three 600 ampere, 250,000 kva. feeder breakers and associated apparatus. Instrument array on each panel indicates volts, watts and vars (reactive volt-amperes) a relatively new arrangement which is considered more directly useful in operation than the more familiar volts, amperes and power factor arrangement.

Circuit breaker operating current at 125 volts is provided by a 60 cell storage battery. The batteries are held at full charge by a Rectox, static type, wall mounted, one ampere battery charger.

Primary feeders are extended to substations at load centers. Cables are paper and lead 15,000 volt, 3 conductor, 350 MCM. One circuit feeds the 150 kva. boiler house substation. Two circuits are run in underground fiber conduits to the main building substations.

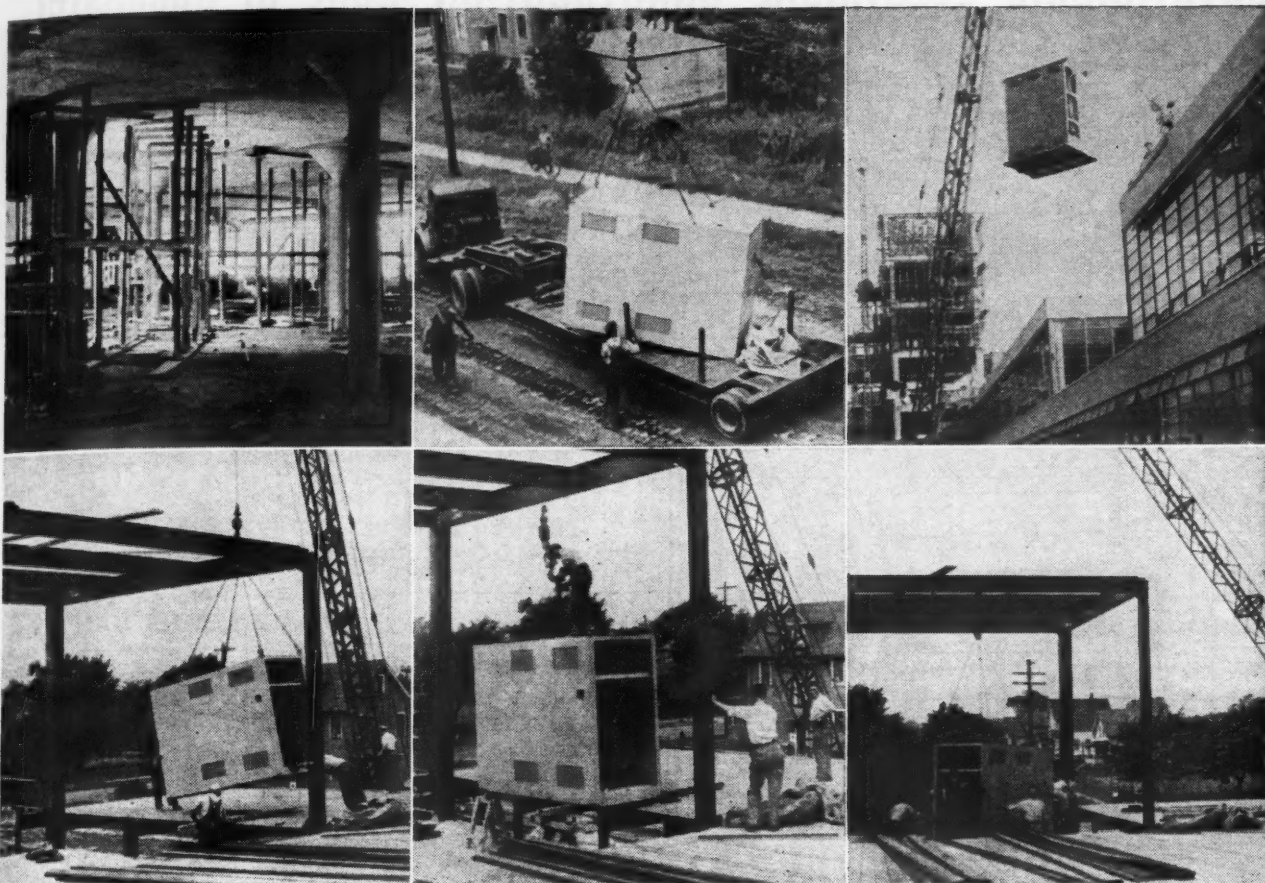
Three manholes break the underground conduit runs. In each manhole cables terminate in subway type connecting boxes and split to the various substations. Cables are fire-proofed in the manholes by an application of asbestos tape dipped in waterglass.

Feeder A serves substations 3, 5 and 8. Feeder B serves substations 2, 6 and 7. Substation 4 is served by either feeder through a double pole transfer switch. All substations are provided with similar transfer switches and spare primary conduits.

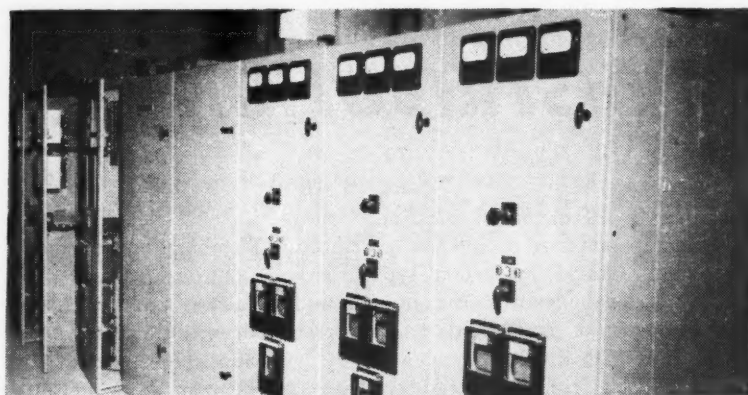
Substation connections are shown on the accompanying schematic diagram. Substations are totally enclosed, metal clad, free standing unit assemblies, with 3 phase, gang-operated interlocked primary selector switch, dry type transformers, air blast cooling, and network protector or secondary main breaker.

An annunciator with a warning bell in the maintenance department indicates excessive transformer temperature or overload operation of the main circuit breaker or network protector on any of the unit substations.

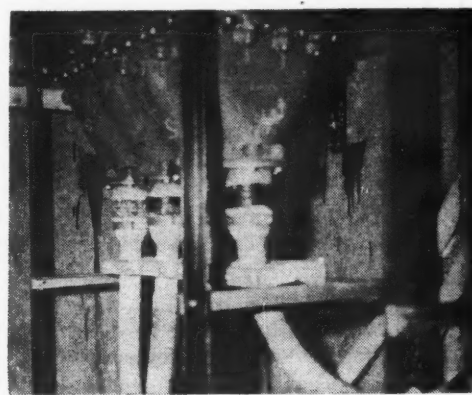




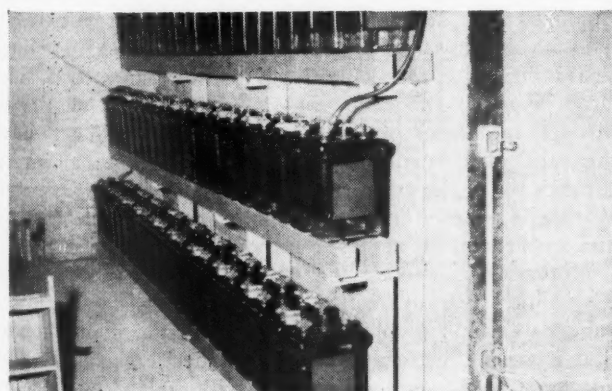
Hoisting a substation section. Shoring gives added protection to roof, crane picks section from truck, maneuvers to roof landing, eases to final level, rollers skid to fan room location.



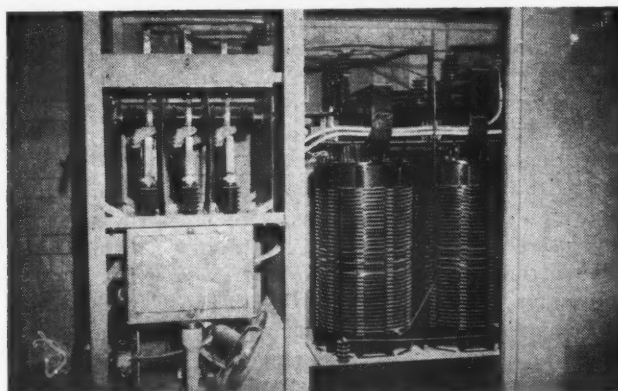
Primary switchboard in boiler house controls 11,400 volt feeder circuits to substations.



Boxes in manholes provide for feeder branches.



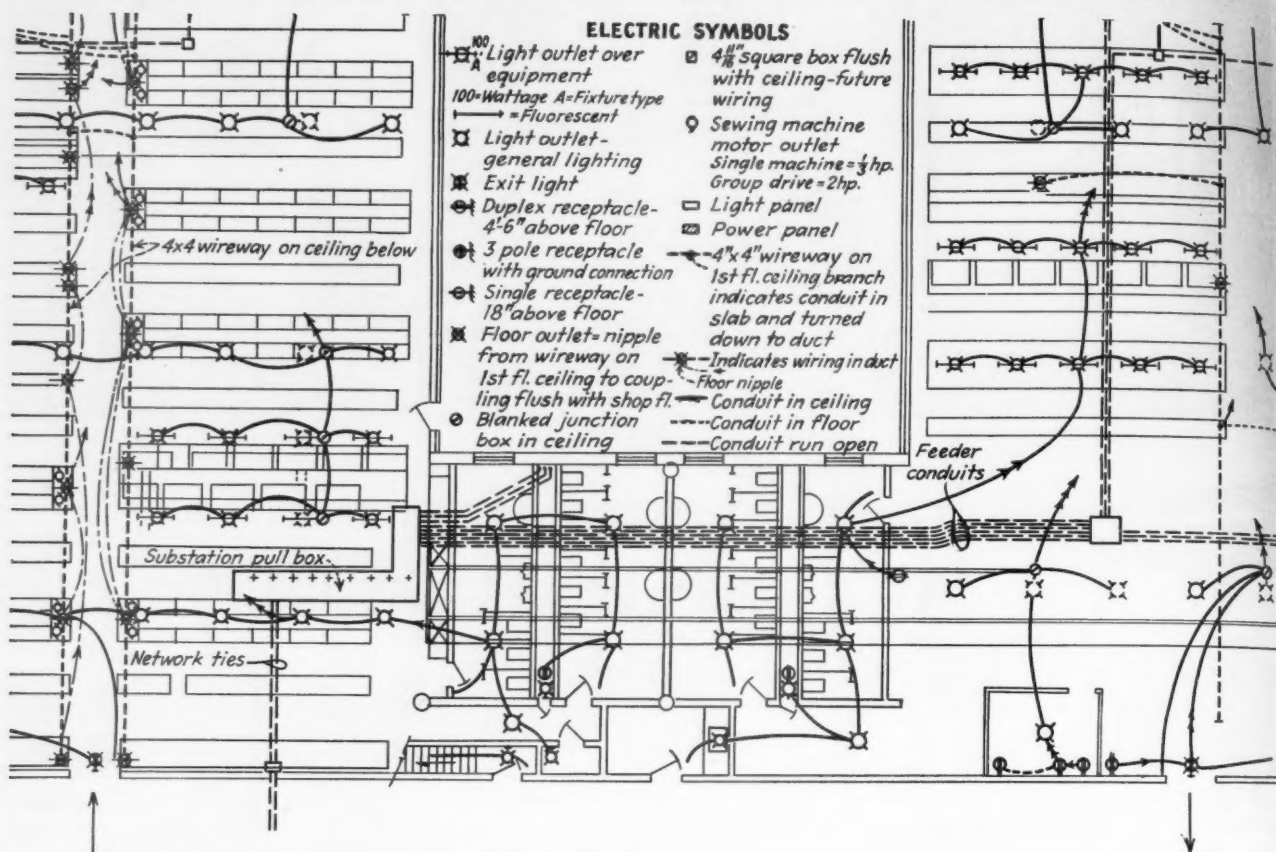
Batteries in boiler house operate switchgear, others provide emergency lighting in plant.



Substations (cover removed) are equipped with air blast cooled transformers and network switches.



# OUTSTANDING ELECTRICAL CONSTRUCTION—Bond of Rochester



Typical secondary distribution wiring. Pull boxes below substation terminate exposed feeder conduits. Nipples extend to substation cubicles above. Obstructions required frequent offsetting in feeder runs. Bends were made on the job with hydraulic conduit benders.

## SECONDARY DISTRIBUTION

Circuit breakers on the load side of the unit substations control secondary voltage distribution throughout the plant. Feeders drop through conduit inserts in the floor to a pull box below each substation.

Pull boxes had to be specially designed and fitted for each substation due to the complexity of structural details and other mechanical facilities which tended to be concentrated in the same general areas since substations are installed in or adjacent to fan rooms.

Detail drawings were developed by the electrical contractor's staff and checked against architectural details and other mechanical work as well as consultation with other contractors. Care paid off because the pull boxes when finally installed fitted accurately and practically without job alterations.

Feeder runs are in exposed conduit. Detailed working drawings on the conduit runs were prepared in advance and inserts set before the pour. Extra care here also proved time saving when installation was in progress, only one relocation was necessary and that due to plan changes.

The presence of unusual amounts of other mechanical work required a substantial amount of offsetting on the job to clear obstructions. Hydraulic pipe benders (Greenlee) gave excellent uniformity and speed on this work, most of it in 3½ and 4 inch sizes.

Panelboard locations are usually on centrally located columns or interior partitions. The building columns are round, mushroom types but were flattened on one side at panelboard locations. Rounded cabinet trims on narrow type panelboards and a vertical wireway up to the column cap make for exceptionally neat appearance and safety.

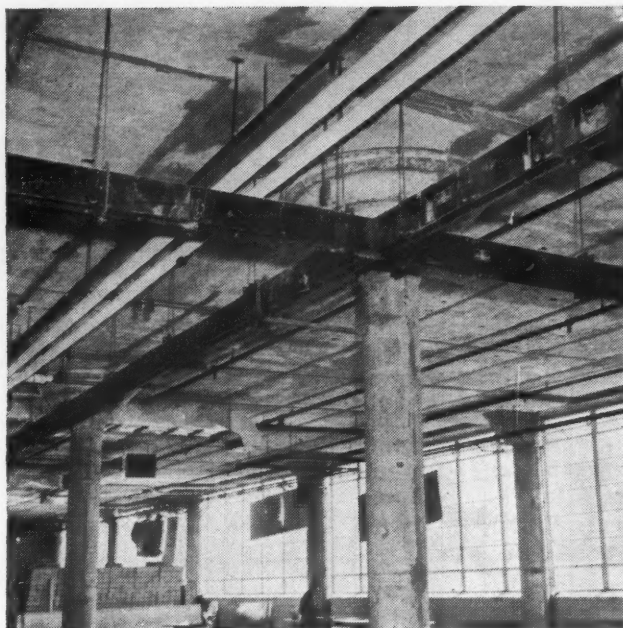
It is usually difficult to conceal wiring in mushroom columns. The round conical cap does not offer a good background for heavy feeder conduits exposed. The method employed took some planning but worked out very well. The feeder run is terminated in a pull box on the ceiling just in front of the column cap on the panelboard side. From a pullbox above in the slab a short run ells down through the center of the column and ells out just under the cap. The smaller branch circuit conduits ell down through the cap to come out close to the face of the column. Wiring is enclosed in the vertical wireway above the panel and a neat trim fits against the bottom of the conical cap.

Motors on the second floor are fed through a network of 4 by 4 inch wireways with 1½ inch home runs to the power panels. Conduit nipples extend through the floor grouted into a preset sleeve as shown in a detail sketch on the adjoining page. A ¾ inch nipple with welded on anchors is grouted into a preset sleeve and finished off with a brass plug.





Secondary feeders run exposed from pull boxes below substations. Structural features required planning of runs, accurate offsetting.



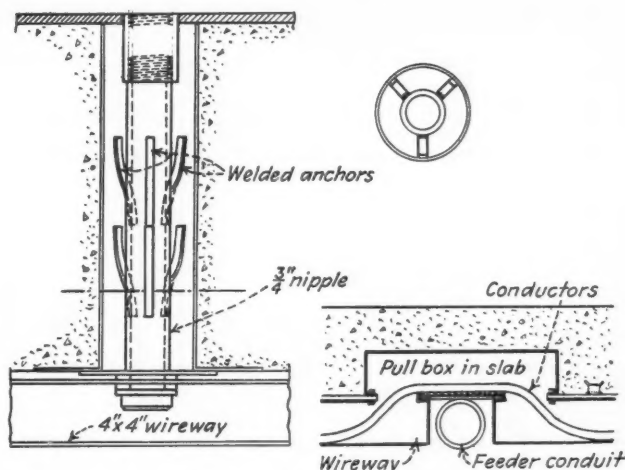
Bus distribution serves machinery in extensive maintenance shops. Connections will be made through bus plugs.

Wireways are code gage sheet steel with hinged covers and locking screws. Power circuits are extended to motor locations from the floor sleeves in conduit.

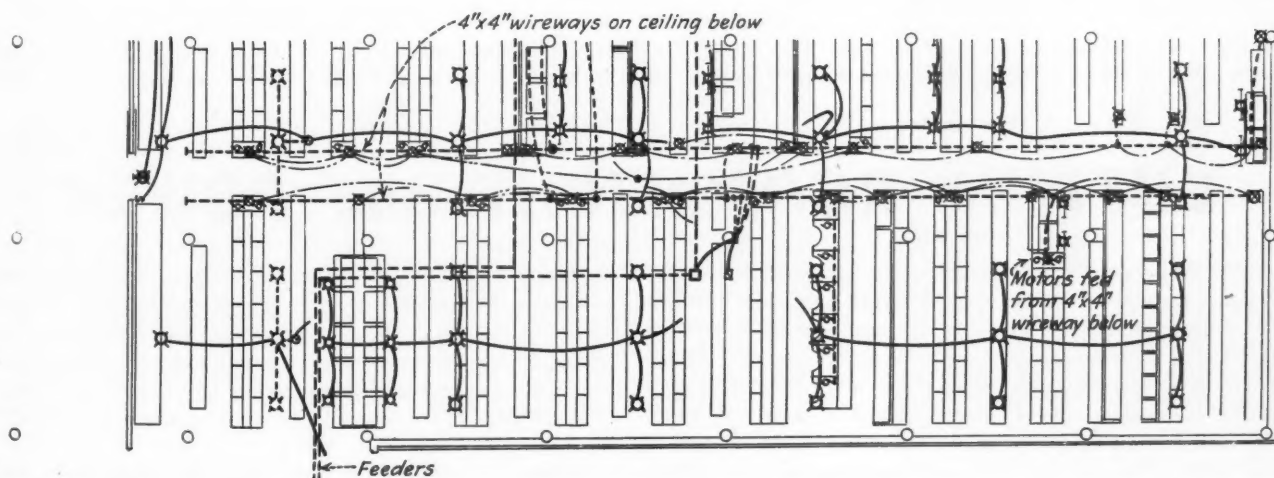
All panelboards are dead front circuit breaker types, the lighting panels arranged for 120/208 volt 4 wire solid neutral and the power panels arranged for 208 volts, 3 phase, 3 wire. Where branch lighting circuits use a common neutral, circuit conductors are connected to separate phases in the panelboard.

In the maintenance shops, power distribution is provided by a busbar distribution system consisting of enclosed busbar feeders and plug in devices.

Secondary switchgear is self supporting, fully enclosed manually operated, draw out air circuit breakers rated at 600 volts, 3 phase. Disconnecting mechanisms automatically trip the breaker if an attempt is made to remove it in or out of the connected position. Indicator lights show whether breakers are in open or closed position.



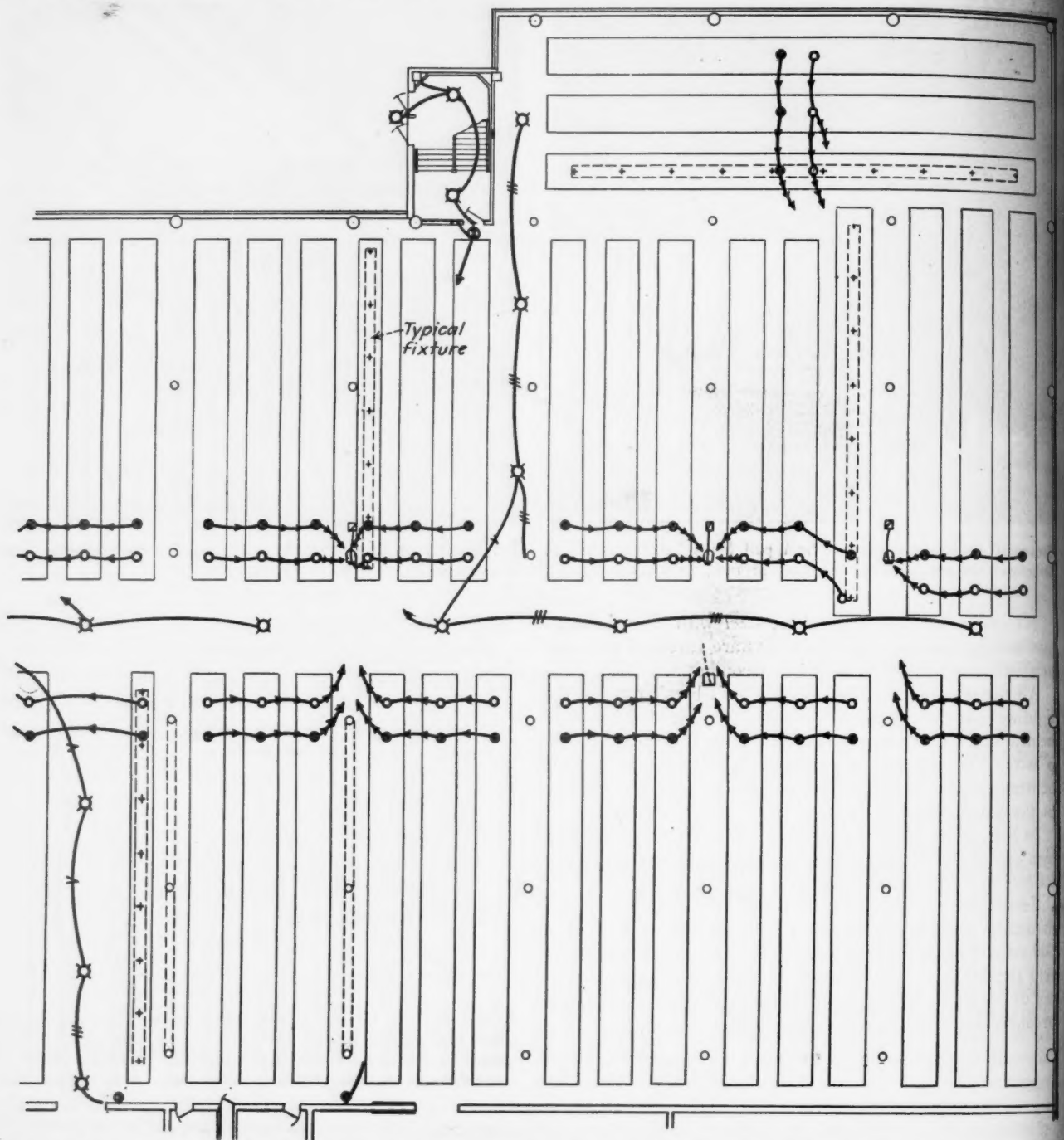
Connection from wireway to floor above is made through  $\frac{3}{4}$  inch nipple and coupling finished off with a slotted brass plug. Anchors welded to pipe prevent turning in grout fill. Wireways obstructed by feeder runs are connected through pull boxes set in slab as shown.



Typical power circuit layout. Wireways on ceiling below connect through stubs (detailed above) to motor circuits. Home runs to power panels are  $1\frac{1}{2}$  inch conduit.



## OUTSTANDING ELECTRICAL CONSTRUCTION—Bond of Rochester



Wiring layout for typical portion of cutting room. Fixtures extend full length of cutting tables and include two rows of 40 watt fluorescent lamps with feedrail between. Separate circuits supply each row of lights and each section of feedrail. Home runs carry 3 circuits with common neutral.

### CUTTING ROOM LIGHT and POWER

One large department of the plant is devoted to cloth cutting. Materials, piled several layers deep, are laid out on cutting tables. Electrically operated cutting machines follow the pattern lines through the materials. Two electrical problems are presented. One involves the critical seeing task. Workmanship must be critically precise, often on dark cloth, requiring high illumination levels. Further, the range of travel of the cutter must not be restricted or impeded by the power cord.

These problems are solved by a specially designed fixture

incorporating two rows of 40 watt fluorescent lamps, one row on each side of a power rail system extending the full length of the table. Short cords from the cutters are connected to trolleys running freely in the power rail. Cords need be only long enough to permit movement to the edge of the table. The trolley allows unlimited movement lengthwise along the table.

Fixtures with power rail are suspended just above head height over the center line of the cutting tables. This mounting and the necessity for unusual strength and rigidity



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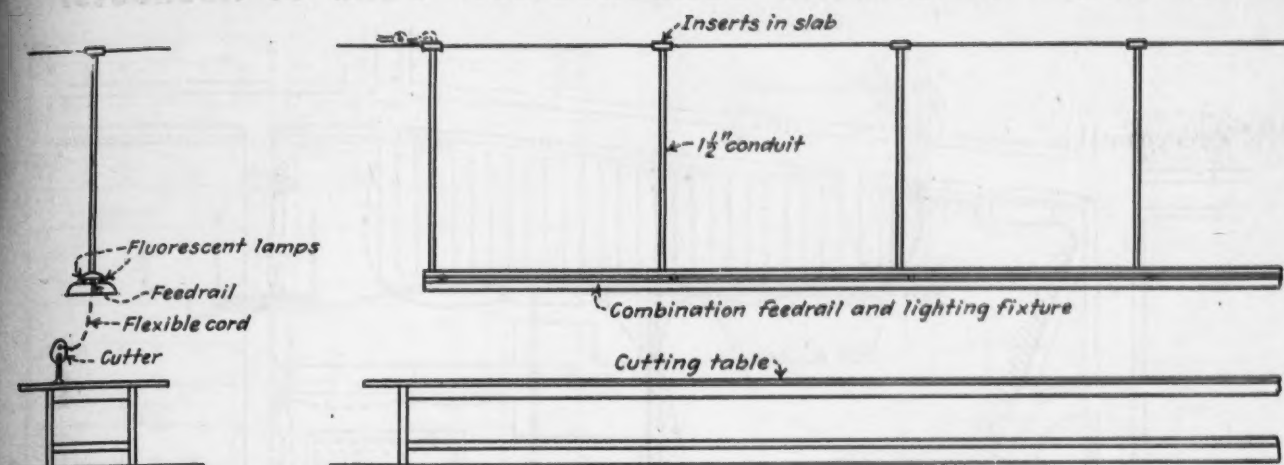
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Combination lighting fixture and power rail for cutters are suspended on 1 1/2 inch conduit stems from ceiling inserts. Wiring connections are made through end support.

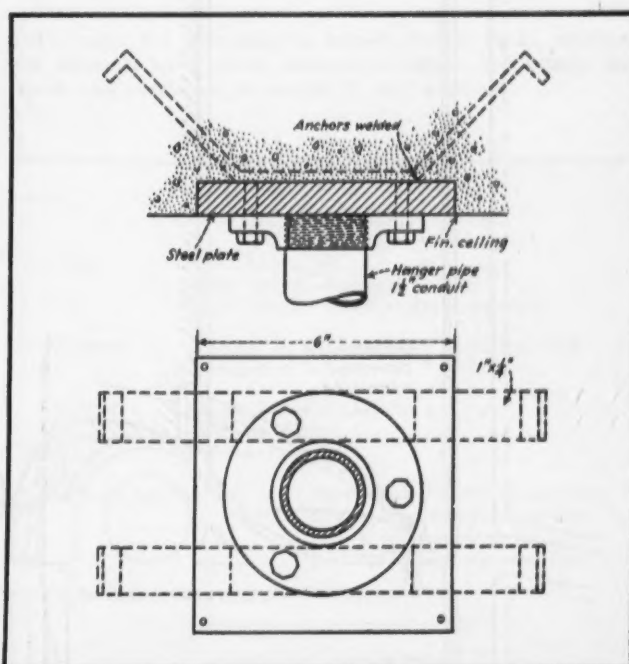
inspired the use of several interesting installation innovations.

Fixtures are suspended from 1 1/2 inch conduit stems spaced on 8 feet centers. Six inch square steel plates, 3/4 inch thick with 1 by 1/2 inch anchors welded to the back were accurately laid out on the forms and nailed in place. When the forms were stripped the plates were level within the minor variations in the plywood form surface.

Flanges were then bolted to the inserts. Lengths of 1 1/2 inch conduit were then accurately machine cut and threaded 3 inches. The factory cut end was tightened into the flange. The conduit stems were then plumbed and minor angles connected by shims on the bolts holding the flange to the inserts.

The long threaded end of the stems hold the top of the fixture between two locknuts allowing for adjustments to level the fixtures within a critical 1/4 inch tolerance. Final adjustments were made with the aid of a surveyor's level giving a very clean and workmanlike aspect to the finished job. The tremendous area of the room with row on row of fixtures at almost eye level required extraordinary concern for accurate line up and leveling.

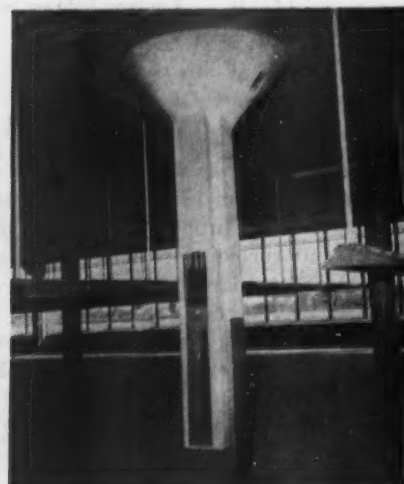
Each table is fed by two circuits, one for the lighting and one for the power rail. Lighting circuits for three tables are combined into a 4 wire home run, the circuits so arranged at the panel to allow a common neutral.



Steel plates with welded anchors support 1 1/2 inch pipe flange. Adjustments were made by shims on fastening bolts.



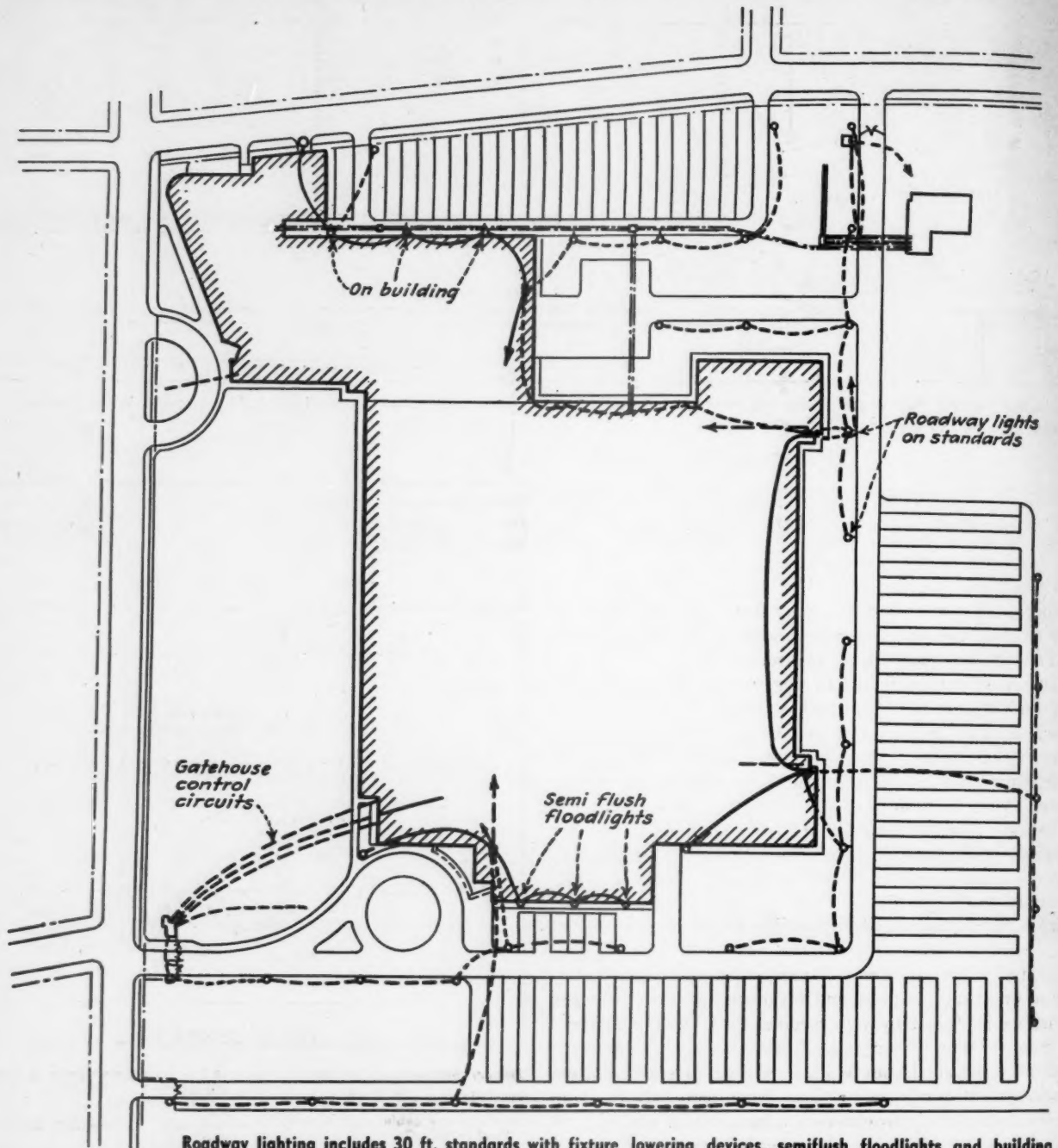
Great areas of cutting room with fixtures near eye level required precise line up and careful leveling. Fixtures on 1 1/2 inch stems carry power rails.



Panel columns are flattened on one side, narrow panels have rounded trim.



# OUTSTANDING ELECTRICAL CONSTRUCTION—Bond of Rochester



Roadway lighting includes 30 ft. standards with fixture lowering devices, semiflush floodlights and building mounted brackets. Controls are provided at gate houses and interior guard room. Wiring is parkway cable.

## Outdoor Lighting

A system of roadway lighting is installed around the three sides of the property not facing the street (Goodman Street) and encompasses all parking areas. Included are 35 lighting standards, 5 brackets on the building and 3 semiflush floodlights.

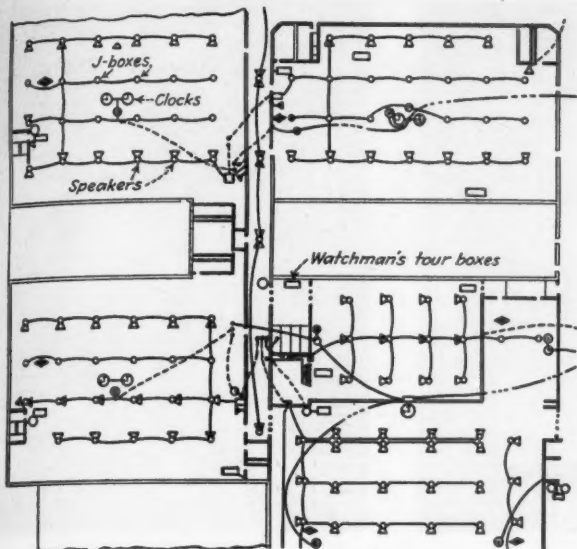
Exterior lighting is fed at secondary voltage, 120/208 volts for conventional 120 volt lamps. Four lighting panels at, roughly, the four corners of the building serve the exterior lighting system. Circuits are controlled by four 30 ampere contactors operated by three wire remote control circuits from control panels in each of the two gate houses and in the interior guard office.

Standards are 25 feet 9 inches with rising bracket

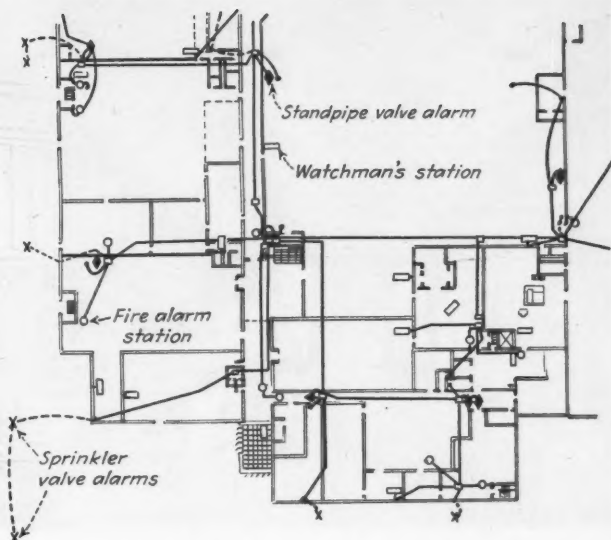


Outdoor roadway and parking area lighting has lowering type hangers for easy maintenance. Luminaires will be Novalux.





Sound system installation covers all shop areas and employee facilities. System provides for industrial music, announcements and radio hookup. Wiring is in conduit.



Other signal and communication features include clocks, telephone, fire alarm, sprinkler alarm, watchman's stations and exterior door alarm. All circuits are in conduit, 3/4 inch minimum.

extended over the roadway. They are equipped with 500 watt Novalux luminaires with a deflector on the building or fence side. Luminaires are suspended on Thompson hangers which permit disconnecting and dropping to ground level for relamping and servicing. Brackets use the same luminaire. Floodlights are semi-flush 200 watt lensed units.

Wiring is installed in parkway cable, with weather-proof neutral, laid under a 2 by 6 creosoted plank in an 18 inch trench. Conduit elbows extend from the concrete foundations to protect the cable at the entrance to each of the lighting standards.

## Special Systems

A building-wide sound system is designed to bring musical programs to shops, general offices, employee lounges and cafeteria. Circuits are extended to 31 local amplifiers and from these to speaker locations.

Outlets for sound speakers are located to provide good distribution of programs without high level output from individual speakers. Provisions are included for microphone locations in the executive offices which may be connected into the sound system for plant wide announcements. The stage at one end of the cafeteria includes outlets for microphones for local entertainment within the cafeteria. The circuits may also be connected into the plant sound system.

Sprinkler alarm wiring includes connections for post indicator valves, standpipes and standpipe control valves. A complete fire alarm system and watchman's system provides for plant protection. Telephone conduits provides for installation of central telephone service. Clock and time recorders are operated by a master clock in the maintenance room and exterior door alarms help provide for plant security. Conduit for signal and communication systems are 3/4 inch minimum.

Emergency lighting is provided for floodlights and exit lights strategically located around the plant. A circuit of 3 No. 1 conductors feeds an emergency lighting panel through a transfer switch. In the event of power failure the panel is automatically switched to a 60 cell 7000 watt capacity storage battery.

## COMPANIES and PERSONALITIES

Owners . . . Bond Clothes, Inc.  
Barney Ruben—President  
Robert Jahelka—Owner's Representative

Architects . . . Albert Kahn Associated Architects and Engineers, Inc.

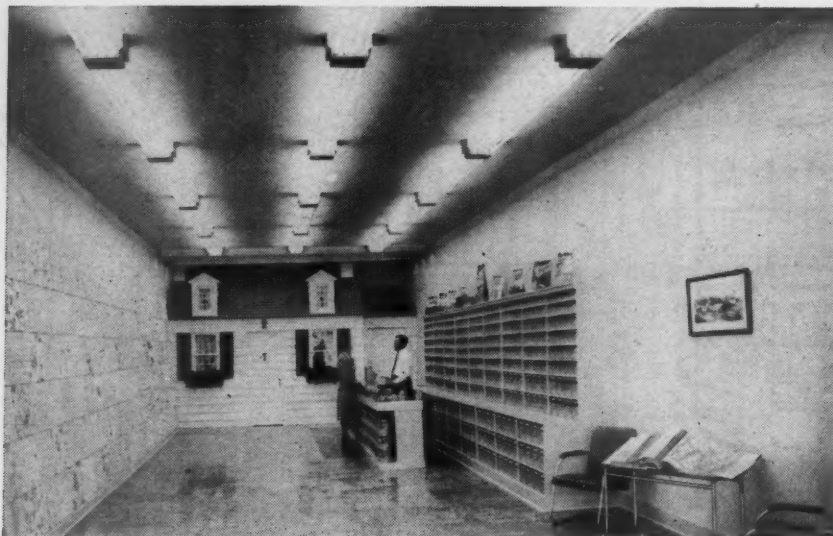
Engineers . . . Eggly-Furlow Engineers  
John W. Furlow  
Walter Lyle

Electrical Contractors . . . Vanderlinde Electric Corporation  
Edward Vanderlinde—President  
Fred A. Jaekle—Vice President  
Carl Pendergast—General Foreman

## MATERIAL SUPPLIERS

Primary switchgear . . . Westinghouse	Controls . . . Allen Bradley, Trumbull, Square D Company, Minneapolis Honeywell
Substations . . . Westinghouse	Power rails . . . Feedrail Corporation
High voltage cable . . . American Steel & Wire Co.	Cutting room fixtures . . . Nulite
Potholes . . . G & W	Shop fixtures . . . Holophane, Garcy, Crouse Hinds, Guth, Workalite
Panels and Cabinets . . . Pelham Elec. Mfg. Corp.	Lighting standards . . . Union Metal
Panel circuit breakers . . . Westinghouse	Roadway lighting units . . . General Electric
Bus system . . . Bulldog	Disconnecting hangers . . . Thompson
Safety switches . . . Bulldog, Trumbull	Wiring devices . . . Bryant, Hubbell
4 x 4 Raceway . . . National	Connectors . . . Burndy
Underfloor duct . . . National	Storage batteries (Swbd) . . . Gould
Parkway cable . . . American Steel & Wire Co.	Storage batteries (Emergency lighting) . . . Exide
Conduit . . . Youngstown	Rectifiers . . . Westinghouse
Conduit fittings . . . Crouse Hinds	Fire alarms . . . A.D.T.
Outlet boxes . . . Steel City	Clocks and recorders . . . I.B.M.
Building wire . . . American Steel & Wire Co.	Annunciators . . . Edwards
Pull boxes . . . Electric Panelboard Co.	Wholesalers . . . Graybar, Westinghouse, G. E. Supply Co., Requa, Kovalsky-Carr
Hardware and inserts . . . Guarantee Iron Works	





*A paint and wall paper store in Euclid, Ohio, uses the products it sells in a tasteful, attractive combination with its lighting system of exposed slimline lamps. In this long, narrow store, 20 x 50 feet, there are three continuous rows of 6-foot slimline lamps, four lamps in each row (120 ma.). The illumination measures more than 100 footcandles.*



*The Arden Store, a small specialty shop in Detroit, has achieved a graceful, efficient use of exposed 8-foot slimline lamps (at 120 ma.) in combination with filament downlights.*

# Appraising Exposed Lamp

Small stores sometimes want their lighting "straight". Under what conditions are exposed lamp installations most likely to be successful? This article reviews the pros and cons.

**By Ward Harrison and J. L. Tugman**

*Engineering Division, Lamp Department  
General Electric Company, Nela Park*

**T**HERE are a considerable number of interesting new lighting installations being made with exposed fluorescent lamps. Most of these installations are in stores, chiefly smaller stores of which the various chain units are representative. We are concerned here with outlining the situations where such installations have the best opportunity to be successful. In outlining these situations we shall also point out that the qualifications for the success of these systems restrict their appropriateness to interiors of certain proportions, and those used mostly for merchandising.

For instance, some of these installations will get into offices where they must be analyzed from quite different considerations from stores. Merchants often have pertinent uses for the brightness distributions they seek when they employ exposed lamp systems. This is rarely the case in offices. And while we grant that merchants frequently do have situations where such installations work well, judgment should be reserved before making general conclusions. In one instance a store may look so garish the proprietor may turn to a new system in three or four years. At the same time another merchant

with an exposed lamp installation may be achieving all the advantages of high level lighting, and winning unreserved acclaim from his customers. The latter instance offers no cause for anxiety, except as it seems to encourage merchants with over-bright, glaring installations to decide to put up with them.

Responsible lighting engineers cannot regard the latter possibility without serious concern. It would be a set-back generally to the cause of advancing lighting practice if the case for well designed examples of unshielded lamps should be stigmatized by the glaring specimens. There are still more than enough objectionable types of exposed lamp installations dating from the early years of fluorescent lighting. At levels of illumination sought by merchants today bare lamps should not be recommended promiscuously.

It is too easy to infer from a successful exposed lamp installation in a store that the same thing will be equally satisfactory for other situations. Easy inferences are likely to get us into trouble, however, as would be the case if we decided to apply the same lighting to an office. We will



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Here is another example of the long, narrow store with sufficient ceiling height to mount the lamps so they do not appear obtrusively in the field of view.

Miller's Super Market, Denver, is a good example of a store in which an exposed lamp installation works well. The 16-foot ceiling is high enough to prevent the lighting equipment from appearing uncomfortably bright to the customers. Each row is made up of two-lamp 8-foot slimline units at 200 ma. combined with 300-watt R-40 reflector floods.

# Installations

do better if we size up every situation with respect to its special lighting needs before making recommendations. Thus we must keep in mind the competitive considerations that apply so strongly to the lighting requirements of one class. Small stores call for a very different order of design technique from offices or schools. Why this is so is apparent with a moment's reflection on the difference in the way customers and sales people use their eyes. In stores it is primarily to vertical surfaces that the eyes are directed. This is quite different from the situation in an office or a classroom where the workers or students are engaged for extended periods with visual tasks from a more or less fixed position. Troffer systems designed to produce desirable results in offices usually make the space they serve look less brightly lighted than they really are. Such a result might be too muted in a store to supply the basic appearance features. But where would exposed lamps offer a desirable solution?

The situations in which exposed lamp installations can be contemplated with respect for good practice are well known. Thus the many long

narrow stores, and stores with high ceilings provide the physical characteristics in which installations can produce advantages with the discomfort possibilities minimized. There are also many stores with beamed ceilings which offer such natural shielding as to eliminate the possibility of brightness discomfort from the usual viewing angles. These are, in general, the situations which offer exceptions to the observance of shielding. This is not to suggest that shielded fixtures would not be pleasing in these situations.

While urging caution in the use of exposed lamps as this development progresses, it is necessary also to comment on the dogma about shielding. Not all the fixtures that claim this feature deserve preference over bare lamps. Some of them, as installed, are as objectionable in every way as the careless use of bare lamps would be. As we move towards the higher levels merchandising methods are demanding, the opportunity we serve requires judicious restraint. Whether by temperament we tend to weight our decisions towards the safety of shielding or towards the simplicity and economy of exposed



An automobile showroom, Powers Motor Co., Detroit, with long, narrow floor space uses continuous rows of four 8-foot slimline units (at 120 ma.) to attract attention. The reflections of these extended sources in the surfaces of the cars accentuates the lines and contours of the bodies and their decorative trim.

lamps, our result should aim to produce lighting free from glare discomfort.

On this problem of shielding and the situations where exceptions may be in order we must remember what comes first in the lighting needs of most small stores. We must emphasize the fact that they need lighting on vertical surfaces to direct attention to merchandise on the shelves

[Continued on page 206]



# ESTIMATES OF EXTENDED DURATION COSTS FOR ELECTRICAL CONSTRUCTION PROJECTS-INDUSTRIAL (SEE NOTES BELOW)

ITEMS OF OPER. COST	I-\$50,000.(SELL PR.) PROJ.				II-\$100,000.(SELL PR.) PROJ.				III-\$500,000.(SELL PR.) PROJ.				IV-\$1,000,000.(SELL PR.) PROJ.			
	NORM. COST		EXT. TIME		NORM. COST		EXT. TIME		NORM. COST		EXT. TIME		NORM. COST		EXT. TIME	
	THE JOB % OF LAB.	PER MO.	COST/MO. % OF NOR.	EXT. TIME	THE JOB % OF LAB.	PER MO.	COST/MO. % OF NOR.	EXT. TIME	THE JOB % OF LAB.	PER MO.	COST/MO. % OF NOR.	EXT. TIME	THE JOB % OF LAB.	PER MO.	COST/MO. % OF NOR.	EXT. TIME
BASE COSTS	1.25 160.		{ MAT. 19,200. LAB. 12,800.		2.75 352.		{ MAT. 40,800. LAB. 27,200.		0.75 1,125.		{ MAT. 225,000. LAB. 150,000.		3.1 9,300.		{ MAT. 450,000. LAB. 300,000.	
EST. DURATION-5 MONTHS	32		4		70.20		14		3.00		200.20		40		6,000.	
EST. DURATION-15 MONTHS	13.25		3		8.50		4		3.00		20.25		5		600.	
EST. DURATION-20 MONTHS	8.50		4		0.2 54		8.50		3.00		20.40		8		600.	
WIRING & POWER-FIELD	0.2 26		5.20		1.0 2.5		8.12		3.00		20.10		2		600.	
TOOLS-CONSUMED & DEPR.	3.5 450.		90.20		18.35		952.		4.875		325.20		65		9,300.	
TIME KEEPER - PRORATA EXP.	INCL. IN OH.		-		0.7 190		27.50		1.050		70.50		35		2,100.	
SUPERVISION	2.75 352.		70.60		42.25		680.		3.750		250.50		125		7,500.	
COORD. DEL.-TO EXPEDITE LAB.	0.3 39.		8.50		4.02		54.		0.18		18.50		9		540.	
TRAVEL EXP.-OFFICE TO JOB	0.25 32.		6.50		3.02		54.		0.15		15.40		6		450.	
INSURANCES & BENEFIT FUND	14. 1,792.		360.-		14. 3,808.		544.-		14. 21,000.		1,400.-		14. 42,000.		2,100.-	
INTEREST ON PAYROLL	0.5 64.		13.-		0.5 136.		20.-		0.5 750.		50.-		0.5 1,500.		75.-	
ASS'N. DUES	0.7 90.		14.-		0.7 190.		27.-		0.7 1,050.		70.-		0.7 2,100.		105.-	
PRORATA CHARGES	0.3 39.		8.50		4.02		54.		0.2 300.		20.20		4		450.	
INSPECTION & PERMITS	0.8 102.		20.-		0.8 218.		31.-		0.8 1,200.		80.-		0.8 2,400.		120.-	
RES. FOR CONTING. & GUARANTEE	5. 640.		128.-		5. 1,360.		194.-		5. 7,500.		500.-		5. 15,000.		750.-	
DIRECT JOB COSTS-LABOR	33.1 4,241.		845.		93. 326.		8,865.		129. 1268.		299. 3,133.		31.08 93,240.		4,663.	
LABOR OVERHEAD	22. 2,816.		563. 50		28.1 18.		4,896.		315. 700.		45. 40		13.8 41,400.		2,070.	
MATERIAL SERVICE, RES. & OH.	9% OF MAT. 1,728.		346. 20		8% OF MAT. 70.		3,264.		93. 467.		20. 20		6% OF MAT. 27,000.		1,350.	
TOTAL OPERATING COSTS	8,785.		1,754.		444.		17,025.		2,434.		537.		83,933.		5,595.	
DIRECT LABOR INCREASE/MO.	4%		512.		285%		775.		133%		2,000.		1% 161,640.		8,083.	
INS. & BEN. FUND INCR./MO.			72.				108.				280.				420.	
TOTAL COST PER MO.			1,028.				1,420.				3,361.				4,974.	

## NOTES:-

- 1-ESTIMATES ARE FOR "60/40" PROJECTS (BASE COST 60% MAT. & 40% LAB.) WITH \$2.00/HR. LAB. & A 5 DAY WEEK.
  - 2-RES. FOR CONTING. INCLUDES ALLOW. FOR INCIDENTALS, ADJ. FACTOR, ETC.
  - 3-ESTIMATES INDICATE THAT DOUBLING THE-NORMAL DURATION PERIOD WOULD INVOLVE AN ADDITIONAL EXPENSE OF APPROX. 10% OF THE CONTRACT PRICE. EACH MONTH WOULD BE IN PROPORTION.
- EXAMPLE- COST PER MO.(EXTENDED TIME) FOR A \$100,000. PROJ. (NOR. DURATION 7 MO.) WOULD BE APPROX.  
(10% OF \$100,000.) ÷ 7 = \$1428. (EST. SHOWS \$1420.)

## CHART I

ELECTRICAL CONTRACTORS' ASS'N.  
OF CITY OF CHICAGO  
R.A.  
12-8-46



# Volume-Duration Studies... Part 3

By Ray Ashley

Research Engineer  
Electrical Contractors Association  
of City of Chicago

Can you determine your costs on projects extending beyond normal time? This discussion tells how to estimate additional expenses incurred.

EVERY electrical construction project has an optimum duration period and any deviation from that time will involve additional expense. Knowing how much to figure for such costs is vitally important to electrical contractors. Such information is of constant value for estimating purposes, and *can frequently be used by contractors to explain legitimate claims for additional compensation.*

Although contractors seldom think of jobs as having an optimum duration period, they generally figure work according to the time the job is likely to run. Experience and labor cost studies have taught them that labor and job costs are usually greater for work which progresses slowly. On industrial projects they have complete control of the work and, not being subject to the progress of other trades, can complete the installation in a much shorter time than they could a contract of the same size for most other types of construction.

Along with the type of project, consideration is given to the effects on duration, of weather, labor market, efficiency of general contractor (if known), job conditions, etc. All such allowances, however, are based on a superficial study of previous jobs and past experiences. There are times when contractors can benefit greatly by having some sound method of estimating costs of extended duration.

In order to provide some means of estimating costs of prolonged duration, the Electrical Contractors' Association of City of Chicago prepared Chart I—"Estimates of Extended Duration Costs." Although this table is based on extensive studies of operating costs, *it is intended only for use as a guide in estimating costs for particular installations.* This can be readily understood when one studies the listing of costs.

Field office, telephone and storage

facilities may all be provided by the owner without charge. On the other hand, engineering costs may be increased 30 percent or more because the field engineer is obliged to stay on the job regardless of the progress. All down the list of percentages shown in Chart I, one may find items subject to increase or decrease depending on the type of project and work progress.

Electrical construction operating costs are too involved to enable one to present a simple portrayal of such a subject as we have here. No doubt most readers will be obliged to study the tables carefully to appreciate their full significance. Such a study will also enable the reader to understand more readily why the relation of the estimated cost per month, for extended duration, to the normal duration period (in months) is so consistent in each of the four examples.

While studying the tables, one should firmly bear in mind that he can not disclaim the existence of listed costs just because cost records do not ordinarily show such amounts. Contractors' books show nothing charged against the job for increased overhead, yet we know that overhead and administrative costs go on as long as the job runs. Again, there is nothing on the books to reflect the losses suffered in the business because operations were throttled by slow moving contracts. It would be difficult to set up all the increased cost of engineering, supervision, tools, and other job costs. Even the costs of direct labor, as recorded on the books, are often misleading.

Foremen and key men are selected for their ability to efficiently direct a crew large enough to complete the work in normal time. If these men remain on the job and it runs twice as long as it should, they are directing work of only one-half the volume that they would normally. While studying

costs of extended duration, a particular example of this kind was called to our attention. The story was about as follows:

A contract was scheduled for the normal time of six months, but it actually ran twelve and one-half months. Progress was normal at the beginning and the crew was built up to eight men. The work then slowed down to a point where only four men were needed. To satisfy the owner's engineer, four of the best men were kept on the job.

At the time the work was figured, the efficiency of the average crew (based on the labor units used) was about 85 percent. The average productivity rating of the four men left on the job, was probably 105 to 110 percent. Suppose it was 105 percent. That would be 20 percent above the average crew for which the labor was estimated.

Although the books showed no penalty charged against the labor, *the job had actually cost the business 20 percent of the estimated labor.* Had the work gone ahead according to schedule, the job could have utilized some mechanics of a lower rating, and at the end of six months the crew would have been free to start another project.

## Job Costs Vary

A job which drags has tools and equipment tied up, and so long as it runs there is a possibility of sudden manpower demands. The contractor's entire organization must stand ready to give such engineering and administrative support as the increased speed of the work may require. All of this tends to throttle the normal business procedure, as well as to increase the cost of the individual job.

There is nothing on the books to indicate the cost to the business, of



## HOW TO ESTIMATE APPROXIMATE COST OF EXTENDED DURATION

### FORMULA:

$$\text{Cost per Month} = \frac{10 \text{ percent of Contract Price}}{\text{Normal Duration in Months}}$$

### EXAMPLE 1:

Job Contract price — \$50,000  
Normal duration — 5 months

Using above formula:

$$\begin{aligned} \text{Est. Cost per Month} &= \frac{0.10 \times \$50,000}{5} \\ \text{for Prolonged Duration} &= \$1,000 \text{ (Chart I shows \$1,028)} \end{aligned}$$

### EXAMPLE 2:

Job Contract price — \$100,000  
Normal duration — 7 months

Using above formula:

$$\begin{aligned} \text{Est. Cost per Month} &= \frac{0.10 \times \$100,000}{7} \\ \text{for Prolonged Duration} &= \$1,428 \text{ (Chart I shows \$1,420)} \end{aligned}$$

the times just described, yet we know they are heavy. Most of such costs are more or less intangible, and one can not point out certain amounts as being definite. Our research and common knowledge of the business, however, enable us to set up certain percentages and amounts which have a great deal to warrant their acceptance as representative figures. Regardless of whether the operating costs listed were high or low, the percentage of extended duration costs would remain the same. Operating costs may be high due to the nature of the work or the methods of operation employed by the individual contractor. One example can be given to show why operating costs vary greatly for different contractors. We shall take tool costs.

One contractor may have a tool cost (consumed and depreciated tools) equal to 2 percent of the job payroll. Another may spend 50 percent more for tools and thereby reduce the job payroll 10 percent. The first contractor would have a tool cost of \$20.00 (2%) per \$1,000.00 payroll. The second contractor would have a tool cost of \$30.00 (\$20.00 + 50%) for each \$900.00 (\$1,000.00 - 10%) of payroll. The percentages of tool costs would then be:—

$$\text{Contractor No. 1: } \frac{\$20}{\$1000} = 2 \text{ percent}$$

$$\text{Contractor No. 2: } \frac{\$30}{\$900} = 3.33 \text{ percent}$$

If these figures were used in Chart I, contractor No. 1 would have less for tools but more for labor. In each case, using the percentages of costs

for extended time, the amount would be in proportion to the normal operations of either contractor.

### Chart I Explained

An overall picture of Chart I will enable the reader to better comprehend how the figures for costs were developed. Installations of four different volumes were studied. Each has its separate table. At the top of each of the four tables is listed the contract price, base material and labor costs, and estimated duration. The items of cost, listed, represent four major divisions:

1. Direct Job Costs—Labor
2. Labor Overhead
3. Material Service and Overhead
4. Direct Labor Increase

Each category will be discussed later.

The costs for each of the four examples are shown in five columns. Columns 1, 2 and 3 show the normal cost, and columns 4 and 5 show the estimated cost per month for extended duration.

In example I (\$50,000 project) cost of supervision is 2.75 percent (Col. 1) of labor. The labor cost (payroll) as listed at the top of the table is \$12,800.

$$2.75 \text{ percent of } \$12,800 = \$352.00 \text{ (Col. 2)}$$

The estimated duration is five months and the prorata cost per month for supervision would then be:  $352 \div 5 = \$70.40$  (\$70. used—Col. 3). Cost of supervision for extended duration was estimated to be 60 percent of normal or:  $0.60 \times 70 = \$42.00$  (See Cols. 3 and 4).

The supervision for a job running

eight months instead of five would then be:  $(5 \times \$70 + 3 \times \$42) = \$476$  or approximately \$480. The average cost per month for the 8-month period would be:  $480 \div 8 = \$60$ . Although cost per month for supervision on the eight month job is only 86 percent of normal, the total cost for the job runs 36 percent above the normal five month job.

### Labor Costs

In the table of expenses there are eighteen items listed for labor, whereas material has only one listing for all combined costs. This is significant. As will be discussed later, the supply of material does not become greatly involved; the supply and management of labor, however, becomes a serious problem.

Out of the four major items previously listed, three were for labor. They are: (1) The direct job costs which always mount when work does not proceed on schedule; (2) the overhead which goes on regardless of job progress; and (3) excess labor which, almost without exception, is a result of prolonged duration.

One cause of increased job labor has already been pointed out. Other causes such as interruptions, lack of coordination of other trades, poor progress of the job as a whole, and similar retarding factors have been treated in previous articles. (EC&M, June & July 1947). The method of determining the percentages of increased labor for use in the tables warrants detailed discussion.

Experience and cost records indicate that, for our purpose here, it is logical to assume that doubling the duration period will increase direct labor costs 20 percent. Using this figure, the cost per month was estimated to be 20 percent divided by the number of months normally required for completion. Table I, Chart I (\$50,000 project) has an estimated duration of five months. The estimated increase in labor becomes:  $20 \text{ percent} \div 5 = 4 \text{ percent}$ . For the \$1,000,000 project, table IV, the estimated labor increase is:  $20 \text{ percent} \div 20 = 1 \text{ percent}$ .

Summing up all the costs, we find that the predominance of expense concerns labor. The supply and management of labor is the major function of electrical contracting, and the principal cost of the business is made up of items designed to expedite labor. The supply of material is only a



secondary cost of electrical contracting.

### Material Services

Extra handling, storing, protecting, and cleaning of material and equipment, are principal causes for increased job costs chargeable to material. Also, there is the item of additional overhead.

The labor expense (handling, storing, etc.) is included in the "Direct Labor Increase" item. Aside from a slight cost for protective coverings and prolonged use of storage facilities, the main cost involves overhead. Studying the figures for "Material Service and Overhead", we find that the allowances per month are low.

For the \$50,000 project, the estimated cost per month for material service is \$70.00. This is 0.36 percent of the total material cost and 0.14 percent of the total base cost (material and labor). For the \$1,000,000 project, the corresponding percentages are 0.06 and 0.27. The total estimated cost per month for extended duration in Table I Chart I is \$1,028. Only \$70.00 or 6.7 percent of this amount is charged to material. The \$1,000,000 project (Table II) has only 5.5 percent of the total charged to material.

An overhead item for material service, even though small, must be included because prolonged duration, as previously explained, puts excessive demands on the whole contracting organization and reduces its volume capacity.

Nothing has been included in the calculations for interest on the money tied up in materials. If there is no provision in the contract for payment upon delivery, there will be this additional item of expense which often amounts to a considerable sum.

### Overall Cost of Extended Duration

A study of the final figures indicates that a formula can be used for making an approximate estimate of the cost per month for extended time. This formula is:

$$\text{Cost per month} = \frac{10 \text{ percent of Contract Price}}{\text{Months Duration (Normal)}}$$

Application of this formula is illustrated in an attendant example.

Of the many things which might cause the resultant figures to vary, the principal one is the M/L (Material-Labor) ratio. As the ratio of Material to Labor goes up, the cost

## EFFECT OF EXTENDED DURATION ON OPERATING COSTS (M/L Ratio - 60/40)

Contractor's Annual Volume (all jobs) = \$300,000

Contractor's Normal Annual Operating

Cost for this Volume (see discussion) = \$40,500

Because some jobs progress slowly it takes 18 months to complete this \$300,000 volume. His organization and equipment are tied up so his annual volume is limited to \$200,000.

Reduction of volume might reduce operating costs to about 80 percent of normal or \$32,400.

Extended duration of six months to complete volume of \$300,000

means an additional operating expense of  $\frac{\$32,400}{2} = \$16,200$ .

Total operating costs to handle \$300,000 volume when jobs extend six months beyond normal time =  $32,400 + 16,200 = \$48,600$ .

Total operating cost to handle normal annual volume of \$300,000 when jobs are completed on schedule = \$40,500.

Operating Cost Percentage:

For normal annual business completed on schedule  $\frac{\$40,500}{\$300,000} = 13.5 \text{ percent}$

For same volume when extended duration is encountered  $\frac{\$48,600}{\$300,000} = 16.2 \text{ percent}$

goes down and vice versa. Reason: most of the cost incurred when a job drags concerns labor.

Let us consider some other figures based on normal operating costs and study the effect of extended duration on annual volume. A contractor may be organized and equipped to carry on a \$300,000 annual volume of normal business. The same contractor may obligate himself to install work which progresses slowly and ties up his organization and equipment so that his actual annual volume is limited to \$200,000. With such work it would require 18 months to complete a \$300,000 volume.

The \$300,000 represents the sell price. For the purpose of figuring, we shall use 75 percent of this amount or 225,000 as the base cost of material and labor and assume that the direct labor for the extended duration has been included. Since we are dealing with 60/40 jobs, the division of base cost will be—

Material  $0.60 \times \$225,000 = \$135,000$

Labor  $0.40 \times 225,000 = \$90,000$

To establish approximate normal operating costs, we can use the following figures—

Material  $135,000 @ 10\% = \$13,500$

Labor  $90,000 @ 30\% = 27,000$

Total  $\$40,500$   
(normal)

The reduction in volume might enable some reduction in operating cost so instead of using \$40,500 we shall use 80 percent of this amount or \$32,400.

With an annual cost of \$32,400, the cost for the additional six months

would be 50 percent of this amount or \$16,200. This amount represents the increase in operating costs only, making a total of \$48,600 for the \$300,000 volume completed in 18 months.

This example is not cited to substantiate the tables for individual jobs as indicated in Chart I. Rather, it emphasizes the increased cost of prolonged duration whether it be on a single project or an aggregate of numerous jobs.

Anyway one figures it, he will find that extended duration costs money. If the completion time is delayed because the contractor is unable to complete the work in optimum time, or because the owner tries to buy the material, someone must pay a penalty. Whether it is the contractor or owner depends upon the form of contract negotiated.

In a previous article, attention was centered on the importance of contractors keeping individual jobs—and total volume—within the limits of their organization's capacity. Here we see that, at the same time, they must select contracts which will either permit them to work at best advantage, or pay a premium for limiting their volume of business. To keep costs of operation down, volume must be kept up to the full capacity of the organization. Any project which tends to restrict normal volume should have a markup designed to compensate for the increased operating costs that will develop.

The next article in this series will explain and illustrate estimating for compensation claims on extended duration projects.



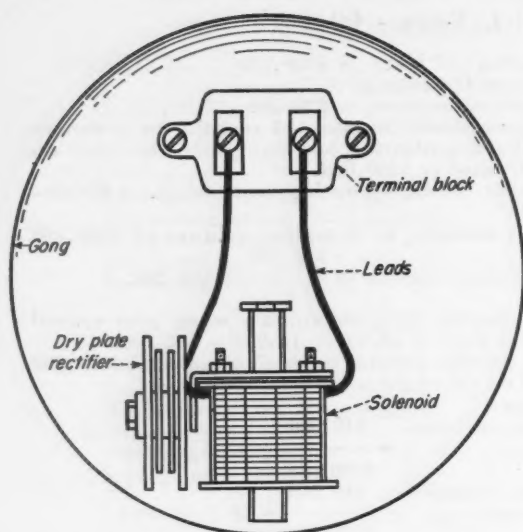


FIG. 1—Simplified mechanism, easy connections mark modern signal apparatus as shown by this typical a-c vibrating bell.

# What's NEW In SIGNALS

Important improvements in signalling and communication wiring and apparatus reflect wartime developments and expanding applications.

By A. A. Schuhler

**P**ROGRESS in signalling and communication equipment is hitting its postwar stride. The war both impeded and enhanced signal development. It restricted the market to the specialized requirements of the armed services but at the same time brought a host of new technical material and methods that are already being reflected in today's equipment.

Standardization has been reached so that the multiplicity of voltages and sizes of the equipment is now held to a minimum. By accomplishing this, the equipment operates more efficiently, installation costs are lower, and it is unnecessary to carry large inventories.

Simplicity is the keyword. An example is in the fact that 24, 115 and 230 volts a-c and 9, 24, 115 and 230 volts d-c have been selected as standard voltages of large bells, chimes, horns etc. Other voltages are obtainable but are considered special. For low tension 24 volts a-c is preferable in most cases since most signaling transformers have 24 volt secondary windings. Small bells and buzzers for household purposes still remain as formerly, that is, 8 to 10 volts a-c or 6 volts d-c.

In the past industrial bells were manufactured in sizes 4, 6, 8, 10, 12 and 14 inches. Now the industry has standardized on the 4, 6 and 10 inch

sizes. Modern sound measuring instruments have shown that the present 6 inch bell has greater volume than the old 8 inch bell, and this is likewise true of the present 10 inch bell as compared with the old 12 and 14 inch bells.

Annunciators and pushbutton blocks are now being produced so that there are a smaller assortment of sizes available. This practice will result in spare indicator or drops and pushbuttons permitting future expansion of such systems. As in the case of the bells previously mentioned such standardization will also result in the increased production and the stocking of such items, making them readily available.

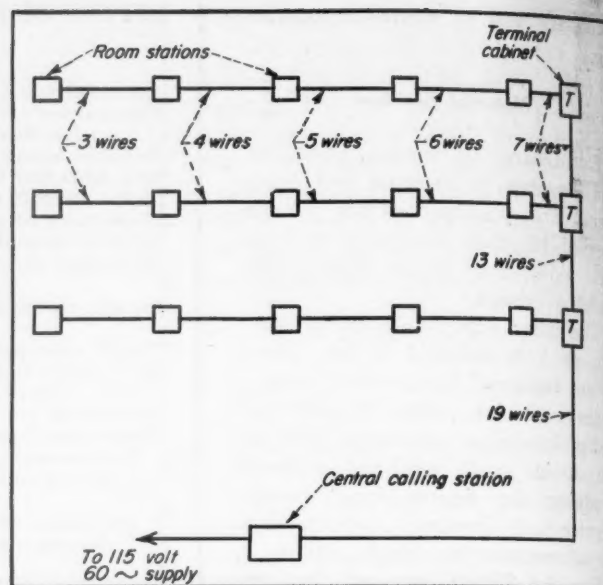


FIG. 2—Selective relay type system layout gives return call operation on new, small size communication.

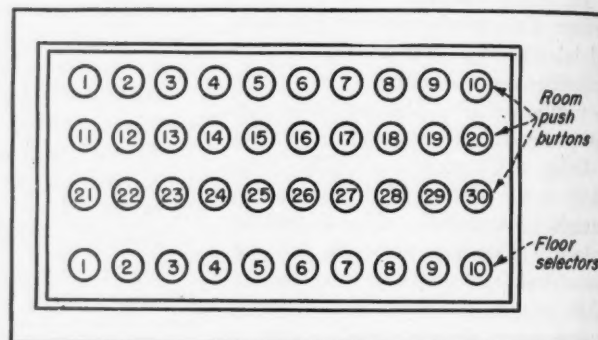
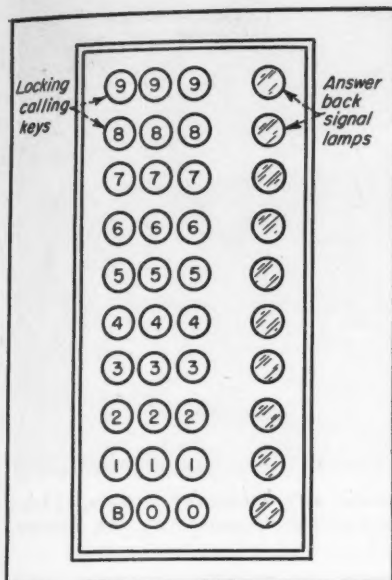


FIG. 3—Pushbutton calling station for 300 room system is greatly reduced in size by floor selectors.



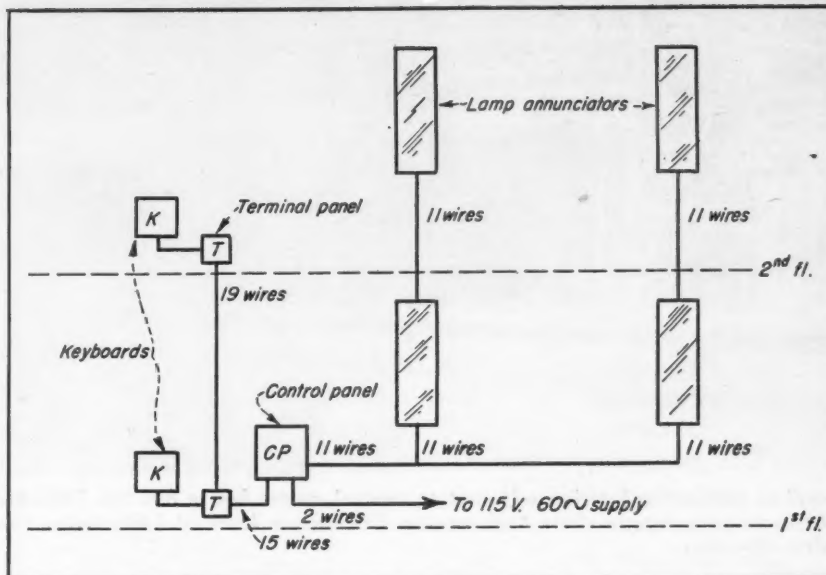


**FIG. 4—Keyboard relay type system uses locking calling keys, central control unit in 12 by 6 inches.**

Equipment has been designed and redesigned for simplicity in installation and maintenance, including less moving parts, ease of connecting and fastening. An example of such development is shown in the accompanying Figure 1, illustrating a later model a-c vibrating bell using a dry plate rectifier which results in a hard hitting even-striking action.

One of the most persistent difficulties in selecting audible signals for areas with different noise levels has now been placed on a scientific basis. The audible signals such as bells, buzzers, chimes and bells are listed in tables having loudness ratings in decibels and American Standards Association units. When compared with the average noise levels for different areas the proper size signal devices may be selected.

Many electrical conductors and cables have been developed with synthetic outer insulations for concealed and surface installations, together with a large assortment of colors, tracers etc. These enable ease of installation since they are readily pulled into conduits, eliminate testing and tagging, and reduce maintenance costs. There are some cases however, where it is desired to identify wires which are not color coded as well as those which are. To conform with terminal connections. To insure permanency, it is suggested that each conductor be wrapped with adhesive cloth bands which may be purchased properly marked for that purpose. In many cases non-color



**FIG. 5—Hospital paging systems can be operated from two points calling as many as six persons at one time.**

coded wires may be pulled into the conduits with such markings.

For connecting low-tension wires to terminals it has been found more efficient and labor saving to use lugs on the conductors rather than use the old method of bending the copper wire. Tools may now be purchased which are designed to skin, clean and crimp the lug in position. This assures accuracy, a positive connection and a workmanlike installation.

Power supply for low-tension signaling systems operating on alternating current is derived from transformers. The standardized voltages range from 4 to 24 in steps of 4 volts, and these may be used in practically any system except in nurses call systems where the taps on the secondary winding produce 10, 12 and 14 volts. It is to be noted however, that transformers are always rated in volt-amperes (watts) on the basis of the highest secondary winding voltage. As an example, if a 12 volt tap were to be used on a 100 volt-amperes transformer having a maximum of 24 volts in the secondary winding, only 50 volt-amperes would really be available to carry the load in the circuit. The 16 volt tap would only produce 75 volt-amperes.

Power supply for low-tension signaling systems, control apparatus, relays, telephones etc. designed for direct current operation but where alternating current is available may be derived from dry plate rectifiers. Storage batteries and battery chargers may also

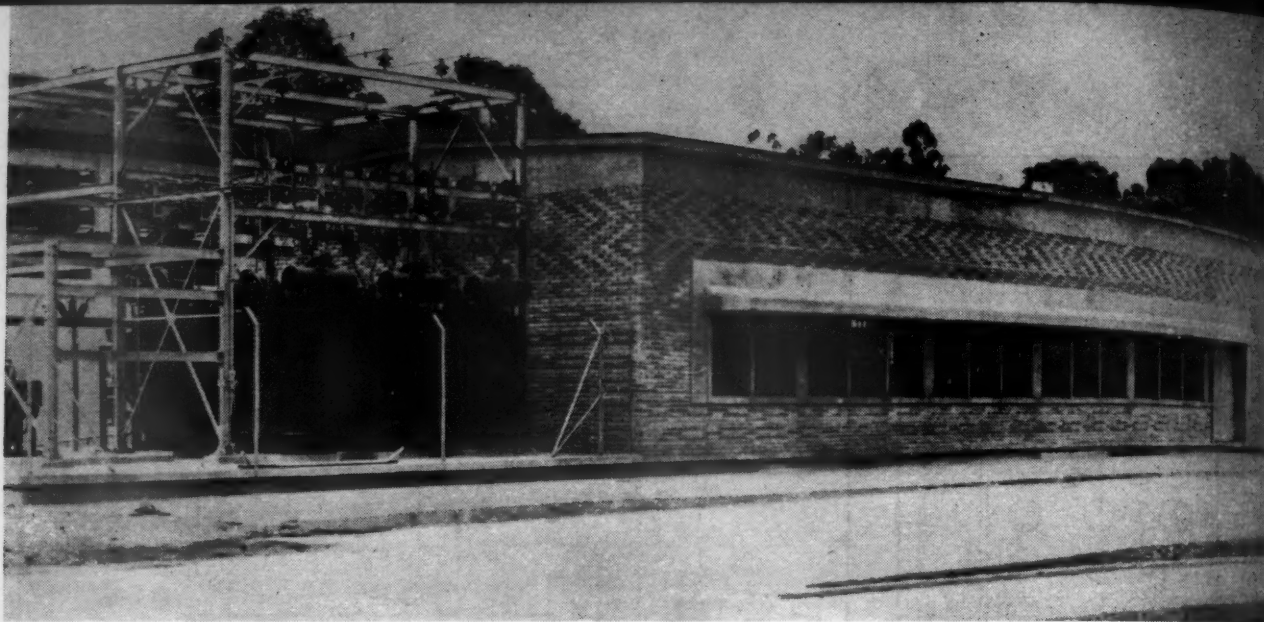
be used, however, these are only recommended in cases where the alternating current supply is not entirely dependable, or where it is desirable to isolate the current supply.

Power supply for low-tension signaling systems and associated equipment operating on direct current where only direct current is available may be derived from the new type d-c rectifier units. The latter is used in lieu of dynamotors, batteries and chargers which have been used extensively in the past.

While there has been no radical changes in the basic signaling apparatus, there have been many developments in the simplification of circuits with a view toward reduction in costs for an entire installation, and also a reduction in the size of the central control equipment. An example of this is in a return call system where a telephone operator or a room clerk is to call a guest in his room and is expected to receive a reply to indicate that the call has been received. The ordinary system would be composed of a return call annunciator at the operator's location with a drop or lamp and a pushbutton for each room. Each outlying room would be provided with a combination buzzer and pushbutton station. The return call annunciator in many cases is prohibitive in size. For instance where 300 rooms are to be considered, arranged for 30 rooms per floor, its size would be approximately 28 inches high

(Continued on page 210)





*Complete outdoor substation adjacent to central power house has two 1850-kva. transformer banks for stepping 23-kv. utility service to intermediate high-tension distribution level of 2400 volts. Characteristics of incoming a-c are 3-phase, 3-wire, 50-cycles.*

# Wiring Mexico's Hollywood

**Electrical engineering, specification of materials and construction of large Mexican motion picture project by New York contractor involves problems of current characteristics, transportation, altitude and rate of exchange.**

**A**LL electrical layouts and working drawings for the mammoth motion picture studio project recently completed for Productores Asociados de Mexico were made in the New York City offices of the E-J Electric Installation Company. The vast electrical system was installed by Mexican labor under the direction of Louis de Zamacona, a Mexican electrical engineering graduate from the University of Pennsylvania. Overall responsibility was in the hands of Jac R. Mann, vice president of the E-J Company, who made frequent flights between home office and job site to personally supervise unusual installation details and to expedite the purchasing and shipping of all materials. Electrical construction in the 25 buildings on the 31-acre tract was undertaken by the Mexican affiliate of E-J Electric Installation Company; Electrica Mexam, S. A.

The installation includes a complete substation with duplicate transformer banks each having capacities of 1850 kva.; a power house containing ap-

proximately 60 running feet of metal-clad switchgear cubicles and two 500-kw. m-g sets; and a distribution system serving 170 distribution panels and 82-600-amp. bull (heavy duty) switches through four miles of underground fiber and concrete duct and 50 miles of cable ranging in size from 12 gauge to 500 MCM. Primary a-c at 23-kv. is stepped to 2400 volts and carried at this level to the main areas of utilization where it is further transformed to the application level of 120/208 volts, 3 phase, 4 wire, 50 cycle.

In discussing the installation with Mr. Mann and E-J's president, Theodore H. Joseph, many of the problems encountered were mentioned as being both interesting and unique. Working dimensions and drawings had to be converted from the metric system to feet and inches before specifying linear quantities. Motors, generator and transformer ratings had to be increased above normal to compensate for the 7300-foot altitude of Mexico City. Since the ground level is two feet above the normal water table,

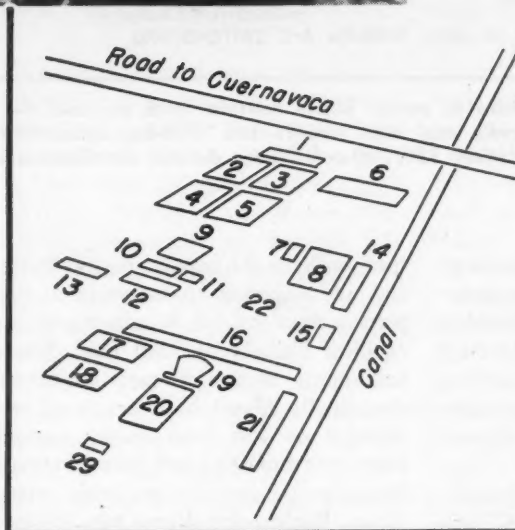
the problem of adequate drainage had to be considered in designing the underground duct system. Electric utility 50 cycle service fluctuated widely in voltage and was subject to frequent interruptions, necessitating the inclusion of regulating equipment and stand-by gas-driven generators to insure the continuity of service for the film laboratory processing. With materials purchased in the United States and installed by Mexican electricians, two currencies and the rate of exchange had to be considered. Building plans and electrical requirements were altered even after installation was begun, in one case an entire building (containing dressing rooms for 500 people) was relocated at the opposite side of the 31-acre lot. This required the rechecking of circuits and equipment and frequently the demand for additional equipment from the remote sources of supply in the United States.

Perhaps the greatest single problem was that of transportation with normal shortages and manufacturing delays being aggravated by embargoes.



Air view of Productores Asociados de Mexico indicates general plan of modern motion picture studio project. Each stage is 400-feet in length. When completed, the development will include 25 buildings on the 31-acre area. All electrical equipment was specified and manufactured in the United States. Electrical installation was by Mexican affiliate of New York electrical contracting firm.

By  
Hugh P. Scott



### KEY PLAN Studio of Productores Asociados

1. Laboratory
2. Stages 12 & 14
3. Stages 11 & 13
4. Stages 8 & 10
5. Stages 7 & 9
6. Stages 15 & 16
7. Power Plant
8. Shops
9. Dressing Rms.
10. Cutting Rms.
11. Film Vaults
12. Projection Bldg.
13. Restaurant
14. Shed
15. Still Dept.
16. Adm. Bldg.
17. Stage 2
18. Stage 1
19. Music Recording
20. Recording Bldg.
21. Shed
22. Parking Area
29. Garage

war priorities, limited shipping facilities, bottlenecks in warehouses at the border and in-transit losses and damage. It was only through the cooperation of both national governments in allocating priority ratings and the combined use of ships, trucks, trains and planes that construction deadlines were satisfied.

Incoming a-c utility service is received from the Mexico Light and Power Company at 23,000 volts, 3 phase, 3 wire, 50 cycles. Primary metering and testing equipment, combined in an assembly utilizing nine single-pole disconnects, is located on the utility side of a 3-pole horizontal gang-operated horn-gap disconnect switch and an outdoor 23 kv. oil circuit breaker. Six 617 kva. single phase 23,000/2400 volt delta-delta transformers, comprising two three-unit banks with capacities of 1850 kva. each, are connected to the incoming service lines through six 400-amp. two-pole disconnectors and to the main a-c switchboard group in the adjacent power house through over-

head tubular 2400 volt secondary bus feeders.

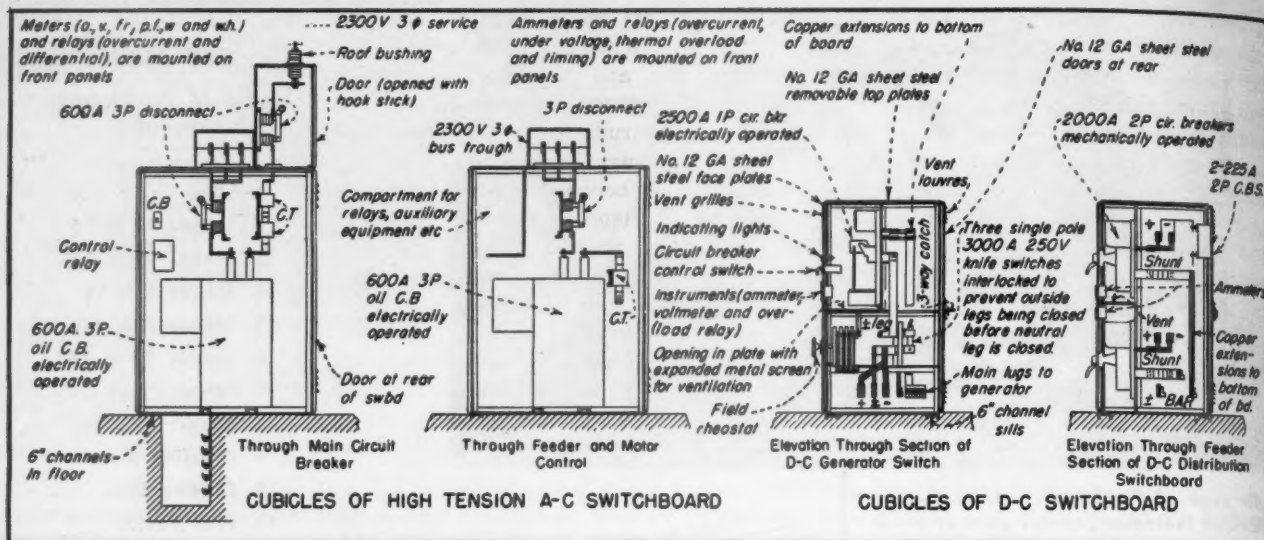
Housed in the power house is a main high tension 2400 volt, 3 phase distribution switchboard; a main d-c generator and distribution switchboard, and the necessary motor-generators. Both switchboards are of self-supporting, indoor, cubicle construction, fabricated from sheet steel treated for rust resistance. Cubicles are fitted with hinged doors both front and back, with all instruments, meters, relays and controls mounted on the front. Interlocking switches on all doors trip circuit breakers when doors are opened. Bus systems connect all a-c cubicles together (3 phase, 2400 volts) and also tie d-c generator and feeder circuit breakers together (3 wire, 120/240 volts). All copper bars are rigidly supported and insulated, tightly clamped with through bolts and have silver-plated joints to insure maximum conductivity.

The high tension board, 32 feet in length and 56 inches deep, consists of 14 cubicles containing equipment to

control and register the characteristics of the incoming service (3 units), the two a-c distribution networks (2 units), a direct feeder to the laboratories (1 unit) and two m-g synchronous motors (4 units now in use with 4 spares for the future installation of two additional m-g sets).

Multiple meters and relays give maximum information to operators and protection to equipment. Main circuit breakers are indoor oil 3-pole 600-amp. units with disconnects on both the bus and line sides of the breakers. Thermal overload indicators are connected to both d-c generators and outdoor a-c transformers. Included on the synchronous motor panels are relays to protect m-g sets against thermal overloads, over-current, low voltage and field failure. Circuits are provided for interlocking the "running" and "starting" breakers of the synchronous motors with their corresponding d-c generator circuit breakers. With this arrangement, generator circuit breakers cannot be closed unless the corre-





**Self-supporting metal-clad cubicles in power house contain both a-c and d-c controls. Incoming 2400-volt a-c feeds high-tension distribution networks and also powers two 750-hp. synchronous motors that drive four 250-kw. d-c generators. These generators deliver 120/240-volt 3-wire d-c for distribution to stages.**

sponding motor is running. Generator circuit breakers trip when the motor circuit breakers are opened. Should it become necessary or advisable to start motors manually, relays and switch equipment on the automatic synchronous starting system can be disconnected through a single switch.

The d-c switchboard will ultimately extend 26 feet in length with a 42-inch depth and a 96-inch height. For pairs of cubicles (2 now in service) will be connected to the generators and the remaining five panels (4 installed) will control the d-c feeders serving 18 motion picture production stages. This switchboard is fed by 120/240 volt d-c from the two 500-kw. generators now in service. Each generator consists of two 125-volt 250-kw. units in series. Generators are compound wound. Design of main generator busbars provides for the future addition of extra generators and final ultimate capacity was the basis for engineering. Positive and negative buses each consist of six laminated  $\frac{1}{4}$ -by-6-inch bars while the neutral bus consists of four similar bars.

All circuit disconnects on the d-c board are air breakers, those on the feeder section being 2-pole manually operated, and those on the generator section being single pole electrically operated with trips for inverse time limit series overcurrent, 125-volt d-c shunt, under-voltage and reverse current. Bell and indicator light alarms are installed on both boards.

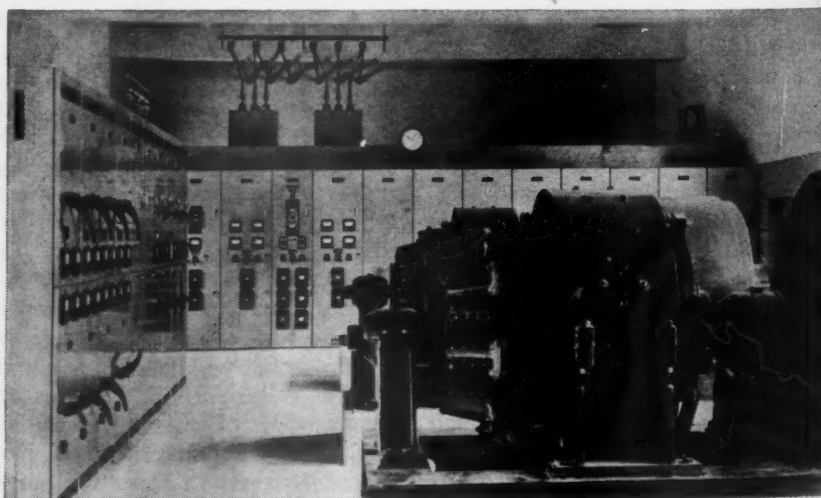
The two 750-hp. synchronous motors on the m-g sets operate at 1000

rpm. with an 80 percent power factor and are designed to maintain a 100 percent overload for 30 minutes at the existing altitude of 7300 feet. Since continuous motion picture sequences are usually filmed in intervals of ten minutes or less, and rarely exceed twice that time, the half hour overload design period provides an ample safety factor. Each motor drives two 250-kw. d-c generators (one connected to each end of motor). This hook-up provides a 3-to-2 wire distribution system and also provides for a 100 percent unbalancing of either generator; a condition which could develop if all lights on one side of the 3/2 wire system on a stage were to be turned off simul-

aneously after filming a sequence.

Feeder circuits, carrying both a-c and d-c from the power house to the 25 buildings on the 31 acres, run from the respective control cubicles through sub-floor concrete trenches to a central outdoor manhole where they enter the extensive underground distribution duct system. Two sets of 2400 volt 3 phase feeders, from separate networks, run to each local transformer station. Double-throw disconnect switches permit these stations to operate on either feeder and provide means to evenly balance the distribution systems for the entire development.

High tension a-c is stepped to 120/



**Both a-c (rear) and d-c (left) switchboards are self-supporting cubicle construction with meters, relays and controls mounted on hinged fronts. Two motor-generator sets with combined capacity of 1000-kw. convert 2400-volt 3-phase a-c to 120-volt 2-wire d-c.**



208 volts in transformer vaults located at the several remote areas of application. Vaults are of concrete, fireproof construction with sheathing shielding floors, ceilings and all walls to eliminate inductive effects on sound recording. Underground ducts connect vaults with manholes conveniently situated along the lines of buried distribution. Transformers of three-phase type were installed for the music recording building while the single-phase types are installed in groups of threes in the dressing room building, laboratories, offices, cutting rooms, projection building, restaurant, shops and various motion picture stages.

Although current delivered to the various stages is ample for the normal lighting of stage settings, additional capacity is available to brilliantly illuminate the large sets necessary for some of the more elaborate musical productions filmed in color. This additional capacity is provided by mobile gasoline-generators and 2400 volt motor-generators that are connected directly by means of portable cables to the sound stage transformer primaries.

Nowhere on the huge movie lot is electrical continuity as important as in the laboratories where the exposed film is developed. Should power be interrupted while duplicate "positive" copies of a film are being processed, the printing of that copy could be repeated. However, should there be a power failure while the original film "negative" was being developed, it would be necessary to restage and re-film the sequences destroyed and would involve the rehiring of extras

and duplicated hours of work for principal actors, directors, stage hands, camera men and technicians. For distribution insurance, a separate 2400 volt a-c feeder runs to the labs directly from the power house, augmented by the two networks previously mentioned. Standby gasoline generators also serve the laboratories to guard against the frequent interruptions in primary utility service. These generators automatically cut in within 20 seconds of such a failure and can automatically cut out again when utility service is resumed.

### Tapered Distribution

Electrical demand on stages is predominantly d-c since high amperage carbon arc lights are used extensively during actual filming operations, giving truer value of colors on the negative with this type of illumination. D-c feeders consist of multiple 500 MCM cables, a group of four large stages with a common service entrance being served by 24 such cables (10 positive, 10 negative and 4 neutrals). Special clamping connectors at intervals tie like cables together and connect main feeders to branch circuits and bull switches. Five 600-ampere 3-pole bull switches are installed on each stage for local distribution, four located on overhead "catwalks" and one at floor level. So that additional feeders or switches may be installed readily, cables are run in covered overhead steel troughs rather than in conduit.

The utilization of cables above the stages is comparable to busduct distribution,

since current carrying capacity is "tapered" as demand is reduced. By this arrangement for example, a distribution section feeding a single main bull switch consists of one positive, one negative and one neutral 500 MCM cable. Feeders serving 2 bull switches consist of 2 positive, two negative and a common neutral cable. A run including five bulls (four above and one at floor level) has 4 positives, 4 negatives and 2 neutrals. The arrangement progressively increases to the joint service entrance for the four stages, at which point the cable arrangement is 10, 10 and 4 to serve the total of 16 overhead and 4 floor bulls. Two separate sets of feeders pass through each stage so that lighting loads can be distributed or staggered and main networks balanced.

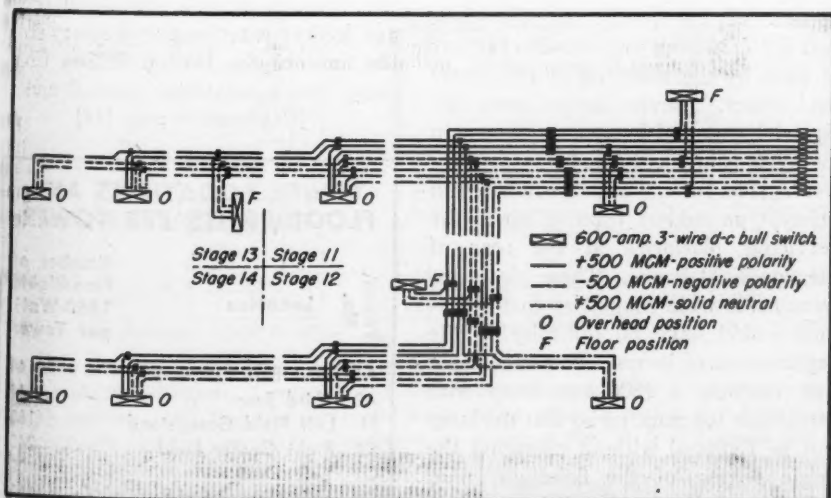
Each bull switch is provided with a 1000-ampere "zero-center" ammeter, connected into the neutral leg only, to indicate perfect balance at zero on the 3/2 wire system.

While lighting of stages is substantially carbon-arc during filming, general illumination is furnished by incandescent lamps in RLM reflectors. Fluorescent lighting is utilized in dressing rooms, offices, restaurant and shops.

Although no explosion-proof equipment is installed in the development, all fixtures are vapor proof in laboratories and projection booths due to the combustible nature of the film. Switches are mercury type so that make-break arcs are inside sealed tubes. Wall receptacles are twist-lock so that contacts break before plugs are withdrawn. All lamps which are not vapor proof are shielded to eliminate the remote possibility of hot shattered glass coming in direct contact with celluloid products.

Productores Asociados de Mexico, like the new modern studios serving that organization, is international in interests, with financial stock equally divided between an association of Mexican motion picture producers and Radio-Keith-Orpheum. Stages are used by all member organizations. To be acceptable to audiences of all nations in the western hemisphere, many pictures are made with identical sets, scripts, musical scores and bit-parts, but with different leading characters speaking English or Spanish with pronunciation or idiomatic variations.

The completed studio project represents an investment of over \$4 million, of which \$575,000 was devoted to the electrical installation.



Group of four large stages is fed by two d-c 12-conductor networks, each consisting of five positive, five negative and two neutral 500 MCM cables. One of these two networks is diagrammed to show connections to bull switches and connector arrangement for tapering number of cables.





Tower B2 is located on grandstand at right center field and supports 240 GE floodlights



Fenway Park, home of American League Boston "Red Sox", was illuminated by over 200 footcandles by 1120 GE Type L-69 floodlights for the opening game of the 1947 season.

# Boston Red Sox Light Up

**New floodlighting installation at Boston's Fenway Park provides over 200 footcandles over entire playing area.**

**By Frederick P. Coffey**

*President  
Anderson-Coffey Company  
Boston, Mass.*

**T**HE owners of the Red Sox authorized us in April 1946 to proceed with the design and installation of all necessary foundations, steel towers, supporting structures, transformer vaults and electric service equipment covering a complete floodlight installation for playing night baseball starting the season of 1947.

A study was made by our engineers of other Major League night lighting installations and subsequently it was determined to proceed with an installation capable of producing 200 maintained footcandles of light on every square foot of playing area in both the infield and outfield.

Under ordinary circumstances eight towers are required for a Major League installation but in this instance the one tower in center field would obstruct the view of spectators in the bleacher area. It was decided to

eliminate this and use only seven towers which meant the loading up of certain of the towers in the right and left field area to overcome the loss of light by the omission of the center field tower. Seven towers were designed by us and located as shown in the accompanying table.

The steel towers were designed with safety type ladders running up to the servicing platforms at the rear of the floodlight banks. These platforms were made wide enough so that workmen would have no difficulty in the replacement of lamps. Each floodlight unit contains a 1500-watt lamp with removable top housing so that the lamp can be replaced without changing the angle setting of the floodlight unit.

Each unit has an aluminum housing with a non-breakable Plex-a-glass front moulded into the aluminum casing.

Only a five-foot width of ground was

available for the installation of the two free standing left field towers which necessitated a concrete foundation running 25 feet below grade. As much as water was encountered at a depth of ten feet below grade it was necessary to install steel cofferdams to facilitate the placing of reinforcing steel and pouring of concrete. Five of the towers were set upon the grandstand roof and connections made to the existing steel structure.

Electric service serving the system consists of two 13,800-volt primary feeders entering the property from the lines of the Boston Edison Company into a substation located under

[Continued on page 214]

## TOWER LOCATIONS AND FLOODLIGHTS PER TOWER

Tower No.	Location	Number of Floodlights 1500-Watt per Tower
A1	First Base	144
A2	Third Base	144
B1	Left Field Grandstand	168
B2	Right Center Field	240
C1	Left Field	108
C2	Left Center Field	168
C3	Right Field	144
Total		1120



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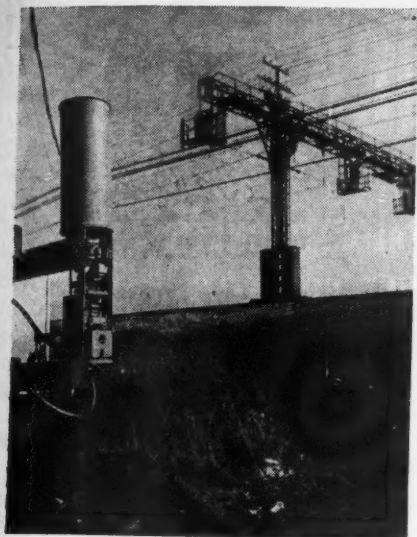


BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

# Practical Methods

## Compact Unit Prevents Electrolysis

WIRING

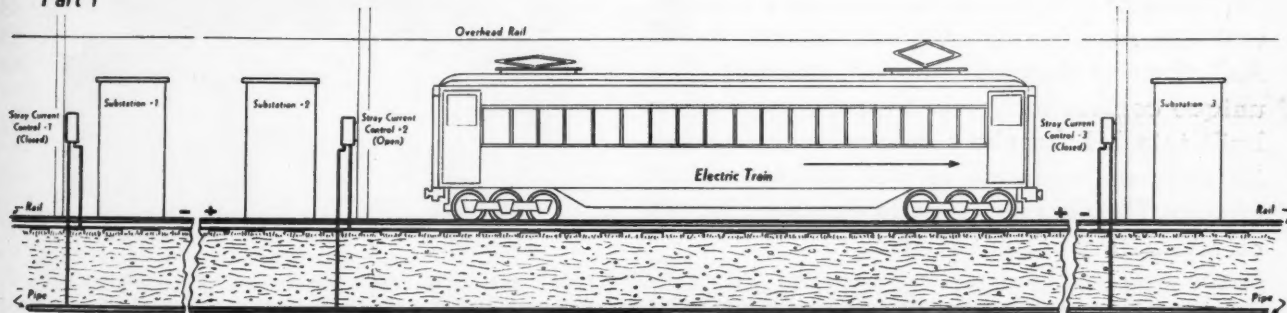


Electrolysis of buried pipe and cable caused by an accumulation of stray currents leaking through the ground from other electric installations (electric railways, etc.) is a subject that engineers have been pondering for some time. Various solutions have been sought to lick this problem which causes an estimated \$50,000,000 damage annually in the U. S. in oil, gas and water industries alone.

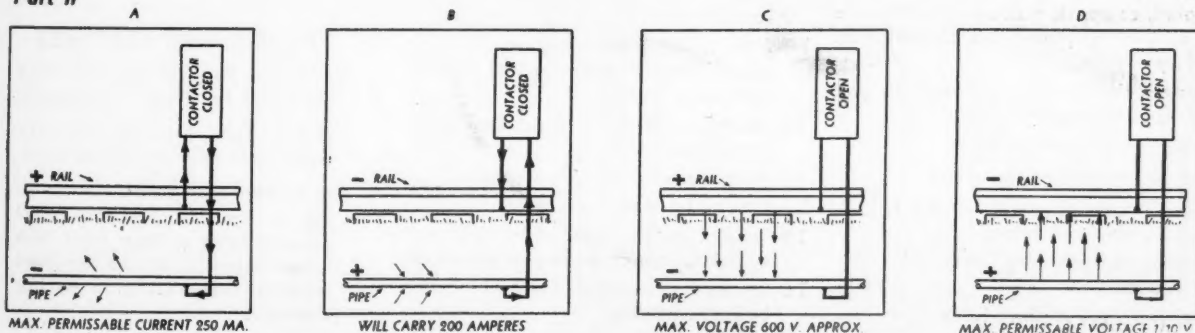
*Open view of stray current control unit mounted to telephone pole in vicinity of electric railway to prevent electrolysis of a paralleling pipe line.*

This phenomenon is particularly severe in areas having an overhead trolley or third rail with tracks forming the return circuit to the power house. Because of the comparatively low conductivity of tracks and varying potential in the rail, the current sometimes leaves the track and enters the ground. Using it as a conduction path, the current then flows to and through a neighboring pipe line, leaving it again when potential changes. Deplating of the metal takes place at points where the current leaves the pipe, especially in damp soil. Eventually the pipe wears through.

Part I



Part II



How stray current units function when an electric train passes installations. Control No. 1 contactor is closed; pipe is positive; rail negative; current flows from pipe to rail through bond (Case B). Contactor at Control No. 2 is open; pipe is negative; rail positive; current flows from rail to pipe through ground (Case C). As train leaves this area, pipe again becomes positive with respect to rail; current tends to flow from pipe to rail through ground (Case D). However, contactor is sensitive to a 1/10-volt potential difference between pipe and rail and will close at

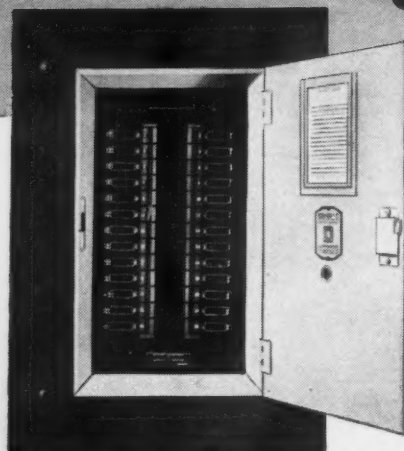
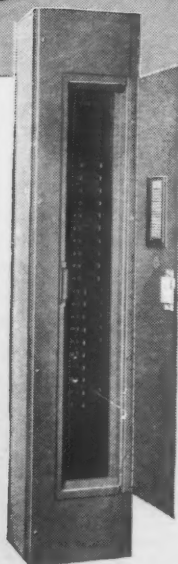
greater differentials resulting in Case B. At Control No. 3, contactor is closed; current flows from pipe to rail through bond (Case B). Large current surge from train as it crosses this section causes rail and pipe to change polarity. At that instant, contactor is still closed and current flows from rail to pipe through bond (Case A). Above a 250 milliamperere surge, contactor opens and current travels through earth (Case C). When train clears area, Control No. 3 will jump from Case C to D to B and so on in continual sequence, B-A-C-D-B-A-C-D-B.



# NEW LOW COST

## NQB CIRCUIT BREAKER PANELBOARDS FOR

## A.C. SYSTEMS



NQB lighting panelboards, using the new ML A.C. breakers are available in double-row, single-pole breakers up to 42 circuits; also in single-row, column-type up to 32 circuits.

• These new NQB panelboards are equipped with the new, highly efficient, Square D ML A.C. thermal-magnetic circuit breakers. The unique *coilless* magnetic tripping mechanism built into ML breakers causes them to open instantly on moderate as well as heavy short circuits. They are specifically designed for use on alternating current systems.

### ML A.C. BREAKER FEATURES

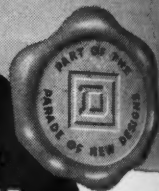
- |   |   |
|---|---|
| 1 Mechanism is completely enclosed in a sealed, compact, molded bakelite case to prevent tampering and for maximum safety | 8 Coilless magnetic-trip element  |
| 2 Narrow slot for edgewise-contact arm isolates arc chamber   | 9 Load terminal   |
| 3 Arc-chamber vent screen   | 10 Main spring (concealed) provides positive contact pressure and strong mechanism action |
| 4 Arc-suppressor chamber  | 11 All steel parts are rust-proofed to prevent corrosion                                  |
| 5 Silver tungsten contacts brazed to contact arms and plates  | 12 Bimetal adjustment screw (sealed)  |
| 6 Bearing surfaces are hardened to reduce wear  | 13 Bimetal for delayed trip   |
| 7 Stainless steel sensitive latch   | 14 Solid, high strength, high conductivity cadmium copper edgewise contact bar            |
|   | 15 Strong cross-section molded bakelite handle  |

Write for information on NQB Panelboards.

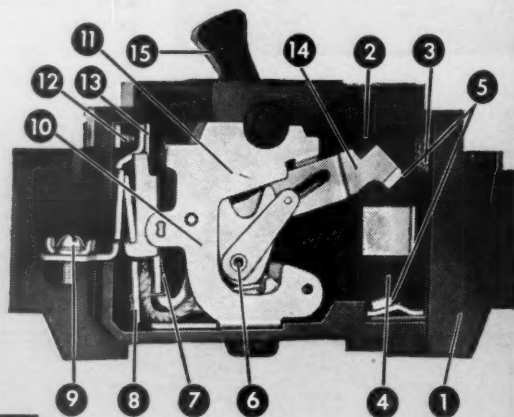
Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

FEATURING

**QUICK** { TRIP  
MAKE  
BREAK  
*Coilless*  
THERMAL - MAGNETIC  
CIRCUIT BREAKERS

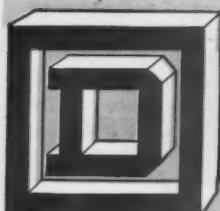


TYPE ML A.C. Single Pole Breakers, Form Q  
15 to 50 Amperes for Alternating Current Systems



### PANELBOARD FEATURES

- Meets Federal Specification WP131A for Class 1 breakers.
- Standard panelboards are made with flush or surface trims.
- Narrow type panels for mounting in web of structural steel columns have surface front with hinged door... can be furnished with special extension wiring channels.



# SQUARE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES

SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.



One method of effectively preventing this action has been developed by the Cook Research Laboratories, a division of the Cook Electric Company, Chicago. Their Stray Current Control Unit prevents damaging electrolysis by: (1) Controlling the flow of current between the pipe or cable and electric railway systems in proximity thereto; and (2) providing cathodic protection of the pipe or cable by maintaining the potential of the pipe or cable at the normal negative potential of the rail.

Electrolysis protection is provided by a switching system controlling a heavy duty contactor which makes or breaks a bonding connection between the rail and pipe or cable. The switching system is so designed that the contactor will close when the rail becomes one-tenth (0.1) volt negative with respect to the pipe or cable, and open when current flow from the rail to the pipe approaches 250 milliamperes (0.25 amps.). Thus, flow of current to the pipe or cable is effectively prevented and current from the pipe or cable is short circuited through the bonding connection.

Cathodic protection is provided by placing several Stray Current Control Units at intervals along the pipe line or cable and the rail system so that, normally, at least one contactor will be closed at all times thus maintaining the pipe or cable at a negative potential with respect to the ground.

The unit is essentially a current and voltage-sensitive device. Current control is obtained by a direct current motor-generator using the field of the generator as a sensing unit. The field has a resistance of one-thousandth of an ohm (0.001 ohm), hence insertion of the current sensing element does not appreciably increase the resistance of the bonding connection.

Voltage control consists of a specially designed two-stage direct current amplifier as the sensing unit. Time delay introduced by the switching relays is less than ten milliseconds (0.01 seconds) to enable quick action at sudden surges of reversing currents and voltages. The complete system, with a design stability of plus or minus 20 percent of rated settings of voltage and current sensitivity, is capable of handling voltages up to 600 volts d-c and current to 500 amperes. Provision is made for variation in line voltage of the supply to the electronic system of from 95 to 140 volts without affecting operation stability.

The alternating current in the rails used for block signal control and switching has been eliminated from the sensing circuits of the unit to prevent erroneous switching.

Contactors and relays require no critical adjustments, hence are easy to install and maintain. The unit, of rugged construction to withstand normal hazards of outdoor unattended service, can be mounted to telephone poles, bridges or nearby facilities. One terminal is attached to the rail, the other to the pipe in question. Complete system ready for installation weighs about 40 pounds, unit container is about 8½-inches in diameter and 18-inches long. Contactor is separate with size depending upon amount of current to be handled.

## Electronic Controls Speed Welding

INDUSTRIAL

The world's largest roll spot welder is the Federal welder shown in the accompanying picture. It is installed in the New Kensington plant of the Aluminum Company of America. It is used for welding .032-inch and .187-inch thick aluminum sheets.

Speeds as high as five welds per second, or up to 300 welds per minute, are common on this welder. This is made possible through the use of Westinghouse electronics controls, which charge as many as 84 capacitors, each rated 120 mfd (10080 mfd), from 1500 to 3000 volts with a peak demand of 100 kva. on a three phase system. Each time this phase is "dumped" into the welder transformer, a weld is formed. The electronic controls for

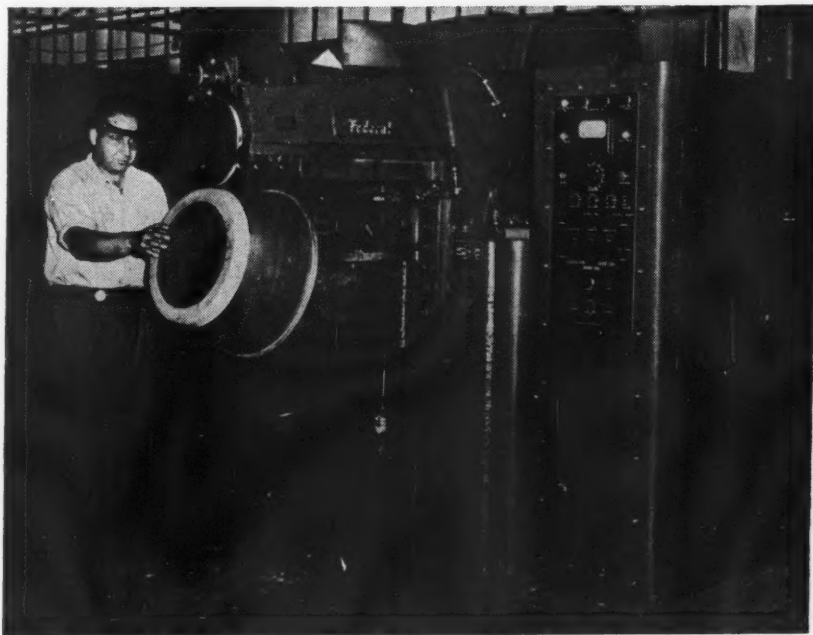
the capacitor discharge system assures the right amount of current for consistent welding results whether .032-inch sheet or .187-inch sheet is being put through the welder.

The operators adjustment panel is conveniently mounted next to the welder, (shown on the right hand side in the picture). The main control cabinet for the Westinghouse capacitor-discharge system which houses the rectifier, voltage regulating system and part of the capacitor bank is housed in another cabinet (not shown) about four feet to the right of the operators adjustment panel. A third cabinet housing the balance of the capacitor bank is located adjacent to the main control cabinet.

## Positive Connections

WIRING

The advantages derived from the use of wire nuts when splicing small wires together have been generally advertised. However, when connecting a fixture wire to a single outlet wire, there is often a tendency for the fixture wire to ride up around the insulation of the outlet wire or to snarl in the nut socket. Jack Kleinberg of Flushing, Long Island, New York, suggests that, by first twisting the outlet wire into a spiral and then laying the stranded fixture wire in this spiral, the wire nut will invariably grip the wires cleanly and securely.



Electronic controls on this Federal welder, permit speeds up to 300 welds per minute and assures consistent welding results.



# Colonial

by

## VIRDEN

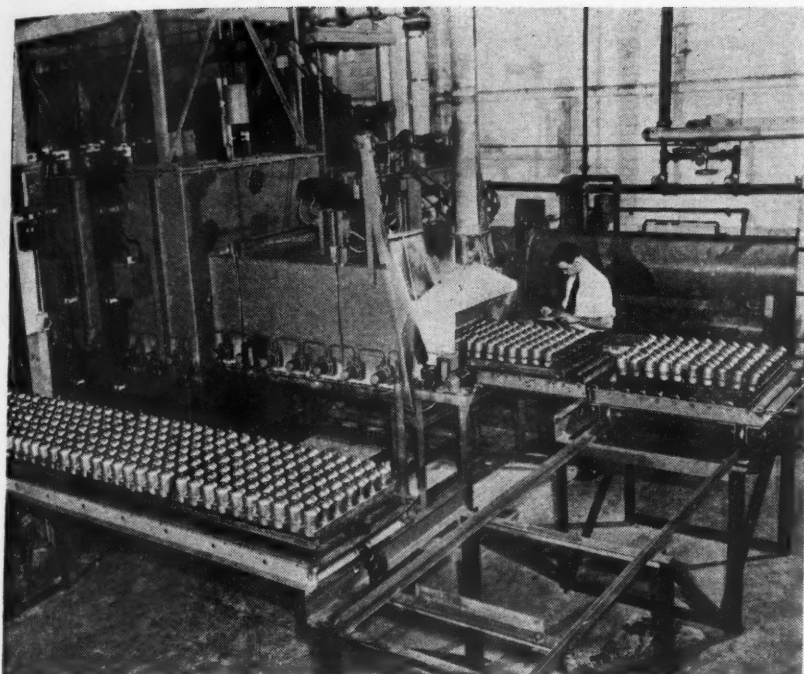
Today there is a decided trend to the Colonial. The current Virden interpretation is in the fine spirit of simplicity, dignity and good taste that characterized this period in American history. Thousands of home builders will discover in these new fixtures the delicacy and restraint that proclaims their authentic ancestry, plus a completeness that meets every modern lighting situation.

From the new Virden Catalog, soon to be available. See your Virden distributor.

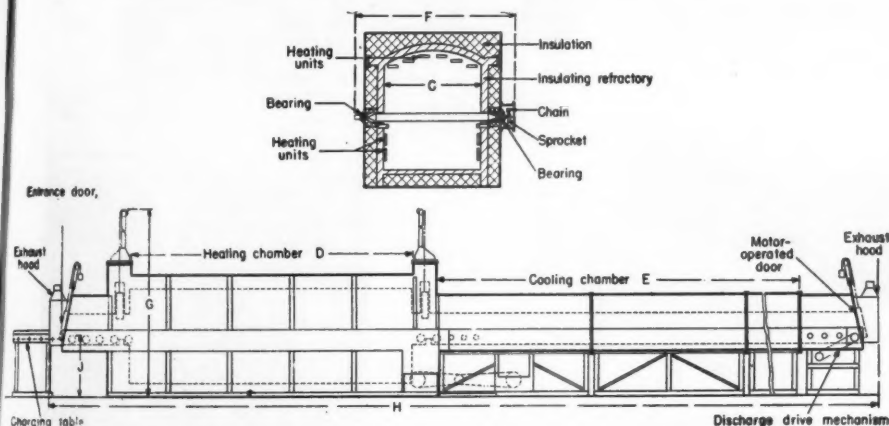


**John C. Virden Company • Cleveland, Ohio**  
*Member American Home Lighting Institute*





**With exception of manually placing bombs in furnace charging trays, bombs are made on assembly line basis, using motor-operated belts and overhead conveyors.**



**Outline drawing of roller-hearth furnace used for brazing insecticide bombs. Heating units are located at roof level and along walls of heating chamber.**

## Electric Brazing

MANUFACTURING

Electric furnace brazing greatly facilitates the fabrication of insecticide bombs at the Aer-a-sol Division of the Bridgeport Brass Company, Bridgeport, Conn. Adoption of this method of brazing has improved the quality of the bombs, simplified construction, and lowered manufacturing costs. The containers, made of .0043-49-inch steel and containing liquid insecticide at 90 pounds pressure, are fabricated at an average of 10,000 per 8-hour shift.

Originally, these containers were fabricated by a bonding method which involved locally heating each joint and

using brazing metal and flux. With this method, considerable difficulty was encountered after brazing in removing deposits of charred flux from the interiors of the bombs. This was necessary since loose particles tended to clog the microscopic orifices of the specially designed dispensing valve of the bombs. In addition, there was the ever-present danger of corrosion from moisture trapped in the bomb. Also a large percentage of the containers leaked.

With electric furnace brazing, inexpensive copper is employed as the brazing metal, and no flux is required.

Consequently, the bomb assemblies come from the furnaces clean and bright, no oxides or foreign matter are present, the corrosion and moisture hazard is eliminated, and the bombs are uniformly tight and strong, testing almost 100 percent free from leaks. In addition, all four of the assembly joints are bonded simultaneously in a single trip through either of the two continuous furnaces.

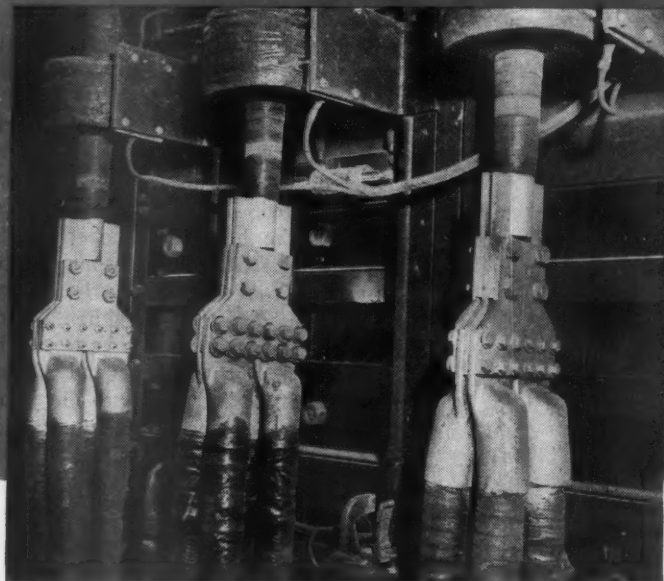
With this brazing process, the assemblies are put together with the braze-metal preplaced near the joint to be brazed. As the containers pass through the heating chamber of the furnace, a reducing atmosphere frees the metal from any oxides present, prevents the steel from oxidizing, and thus prepares the parts to be wetted by the molten copper. When the brazing metal melts it is drawn into the joints of the assembly by capillary attraction and forms alloys with the steel.

Each of the roller hearth copper brazing furnaces used in this application consists essentially of a heating chamber nine feet in length and an adjoining water-jacketed cooling chamber 30 feet long. The heating chamber is equipped with electric heating units rated 180 kw., divided into two 90-kw. zones, each with separate power and temperature control. The heating units are made of heavy rolled ribbon, formed in loops, mounted in the roof of the chamber and on side walls above and below the roller conveyor running through the chamber. The cooling chamber is made of two concentric rectangular steel shells to provide a water jacket, and is divided lengthwise into three sections, each with a separate water circuit. The first section of the cooling chamber has automatic cooling water temperature control, to prevent condensation during idling periods. Rolls are motor driven by a chain and sprocket mechanism.

Throughout, bombs are fabricated almost entirely on the assembly line basis. Belts or roller conveyors carry them from one operation to another until they arrive at the furnaces, where they are manually placed in brazing trays. Trays are automatically charged into the furnaces and travel slowly through them on motorized conveyors. After being discharged from the furnaces and inspected the dispensing valves are added and the bombs are air tested, marked, and charged with the liquid insecticide and then with Freon under pressure. Attached to an overhead chain conveyor, they are cleaned, lacquered, and again inspected. A belt conveyor carries them to the final station, where they are labeled, visually inspected, and finally packed.



# Indoors... Outdoors... Today and 30 Years Ago... ALUMINUM HAS PAID OFF ON MANY INSULATED WIRE AND CABLE INSTALLATIONS



INSTALLED IN 1916 and still operating satisfactorily today. 450 Volt D.C. line carrying 1390 amperes per cable in a Rotary Converter Station. The four 1,590,000 CM aluminum cables insulated with varnished cambric involved 1700 connections to the apparatus.

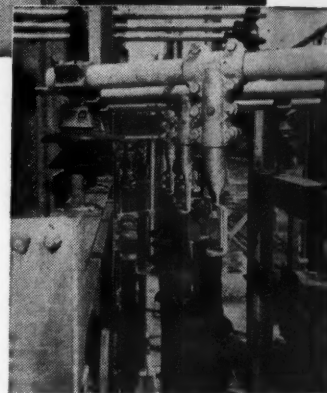
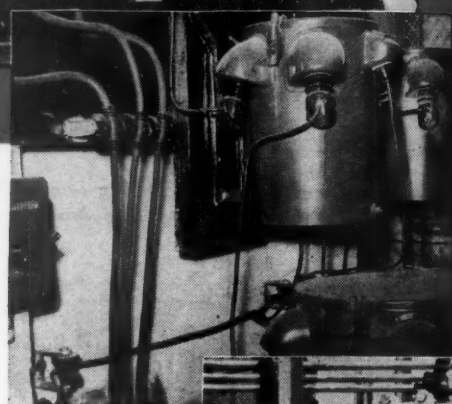
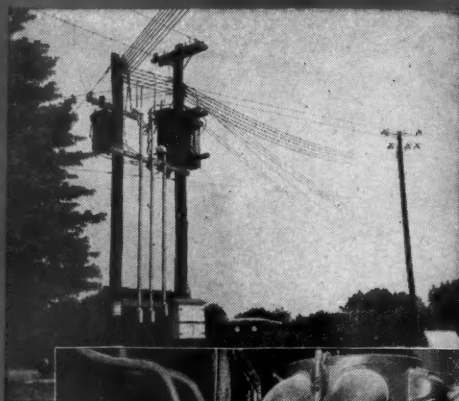


FIGURE IT IN  
ALUMINUM

Hazard insulated aluminum conductors are being used to advantage for many building wire installations as well as underground, aerial and service entrance cable requirements. Cost savings up to 40% . . . weight savings up to 60% . . . easier handling and pulling — results like these make it worth your while to investigate the use of aluminum conductors when figuring a job.

Hazard Performite Type RH Aluminum Building Wire is carried in factory stock and by many wholesalers — for immediate shipment in sizes 6Awg to 500,000 CM. Other sizes and cable designs can be fabricated in as little as 4 to 6 weeks. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

Write for Bulletin H-407-AL which contains tables, calculating data and details of simple splicing and terminating methods.

(Top) LIGHTING INSTALLATION. Performite double braided cable with aluminum conductors used for permanent outdoor lighting wiring at a new sports arena in Pennsylvania. (Center) POWER FEEDER CABLES with aluminum conductors, Performite insulation, Hazaprene jacket, 5KV, used in a state centennial exhibition. (Bottom) HIGH VOLTAGE POWER SUPPLY. 15KV cables with 800,000 CM aluminum conductors terminated outdoors with welded aluminum lugs bolted to aluminum bus in large southern industrial plant.

## HAZARD

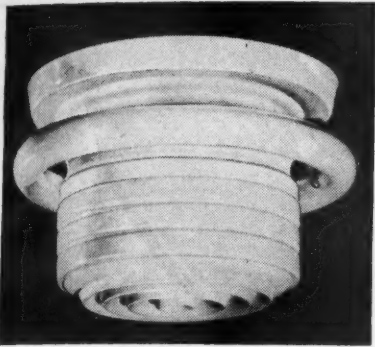


insulated wires and cables for every electrical use



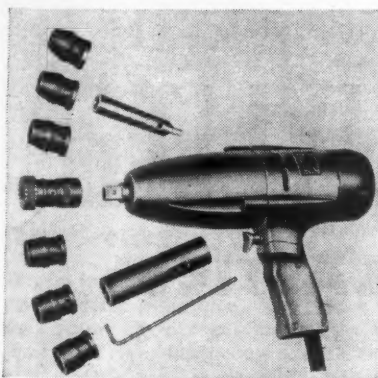
THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising department, tell them in what issue of **ELECTRICAL CONSTRUCTION** and **MAINTENANCE** you saw the item and they will send full details to you.

# Equipment News



## Lighting Fixtures

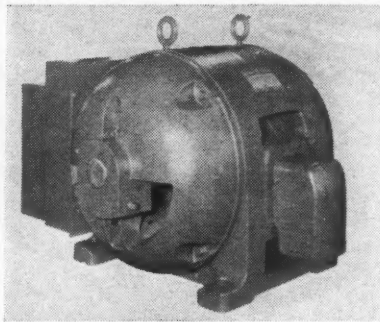
The new "Circle-Plus" kitchen luminaire combines both fluorescent and incandescent lighting, by use of the new 32-watt Circline circular fluorescent bulb and a 100 watt filament bulb shielded by a streamlined white ceramic-glass bowl. The incandescent operation of the unit lights the room the instant the switch is flicked. The fluorescent goes on a few seconds later. The unit uses the latest ballast, starter and clear-plastic holders for the Circline bulb. It measures 10½ in. in diameter, 7½ in. high overall. May be used only on 110-125 volts, 60 cycle a-c. Mitchell Manufacturing Company, 2525 Clybourn Avenue, Chicago 14, Ill.



## Electric Impact Tool

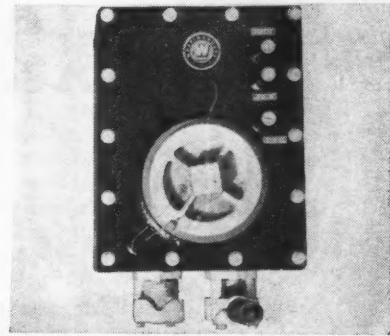
A new universal electric, all purpose impact tool has been announced. Using attachments, it will apply and remove nuts, drill, ream, tap, drive and remove screws, drive and remove studs, extract broken cap screws and studs, run wire brushes, do hole saw work,

drill brick and masonry, drive wood augers. It is designated as Size 4U. It weighs 6½ lbs., has an overall length of 10½ inches, a free speed of 2000 rpm, and delivers 1900 rotary impacts per minute under load. It is powered with a reversible, universal, electric motor, 3 amp., that operates on 110 volt, a-c and d-c current. The impact mechanism permits the spindle to be stalled completely while the motor continues to run; thus eliminating motor burn outs caused by overloading. It also eliminates torque reaction to the operator. Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y.



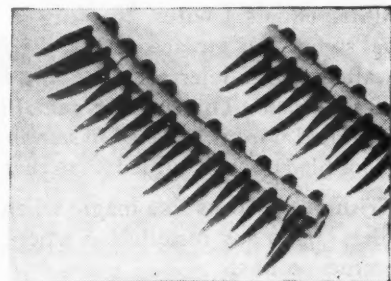
## Power Supply

A new power supply for high speed a-c motors used in the machine tool industry for applications on grinders and drills has been announced. Called the Tri-Clad Type AKC inductor frequency converter, this new self-excited, self-driven machine provides 3 phase power at frequencies from 360 to 2160 cycles, ½ to 150 kw. It consists of a cast rotor revolving in a stator having two windings. The squirrel cage rotor is modified to provide salient pole effect on the output winding of the stator. Input winding operates at standard line frequency and serves as a stator winding to drive the rotor as an induction motor, and also supplies the excitation for the high frequency winding. Control for the frequency converter usually consists of a magnetic switch with conventional thermal-overload relay on the input, or primary side. The secondary, or output high frequency, circuit requires conventional thermal overload protection. General Electric Company, Schenectady, N. Y.



## Linestarter

A new explosion tested linestarter has been developed. It is for use with d-c motors up to 5 hp. on circuits of 80, 115, 230 and 550 volts which may be started by connecting directly to the line. Some of the improvements are—d-c magnetic contactor with knife edge bearings; packing glands that can be bolted in place permitting assembly of conduit and gland away from the starter and then bolting the assembled unit to the starter; a handhole in the cover to facilitate replacing fuses or heaters; an overload relay that can be arranged for either manual or automatic resetting. Available for either automatic or manual reset. Short circuit protection is provided. Westinghouse Electric Corp., Pittsburgh 30, Pa.



## Staple Strips

These insulated staples, packaged in strips of ten, are designed for low voltage or telephone wiring installations. It is claimed that they drive easily, grip firmly. They come in colors to match interiors and are patented, meet government specifications for low voltage wiring. Superior Manufacturing Company, Fitchburg, Mass.





**2x2=at least 8!**

**T**HAT'S ELECTRICIANS' ARITHMETIC—and there's magic in it. Here's how it works: 2 wires in a conduit, times 2 conduits, equals 4 wires. Nothing unusual so far. But replace those old wires with new ones, having thin-walled, high-dielectric VINYLITE Brand Plastic insulation, and see what happens. The conduits remain the same—but the *new* insulated wire is so *small in section* that the number of circuits can be doubled or even tripled . . . so that 2 times 2 now equals at least 8!

This arithmetic works like magic when you're modernizing old buildings—or in any installation where small-diameter compactness counts.

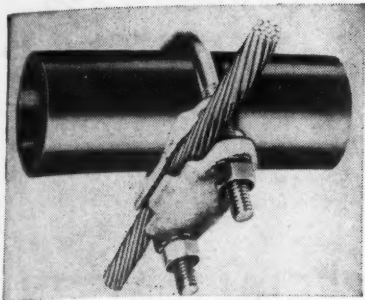
But that's only one advantage of insulation made of VINYLITE Plastic. Certain types are non-flammable, others slow-burning. All are highly resistant to abrasion, most chemicals, grease, oils, alkalis and sunlight. Even at low temperature this insulation stays flexible. And it can be made in a full range of bright colors for easy identification.

Use VINYLITE Plastic insulation in anything from portable cords to power cables. Its applications are numberless. For full information write Department BS-41, Ask for booklet "VINYLITE Plastic Wire and Cable Compounds."

**VINYLITE**  
TRADE-MARK  
**PLASTICS**

BAKELITE CORPORATION, Unit of Union Carbide and Carbon Corporation  30 East 42nd Street, New York 17, N. Y.





### Ground Connector

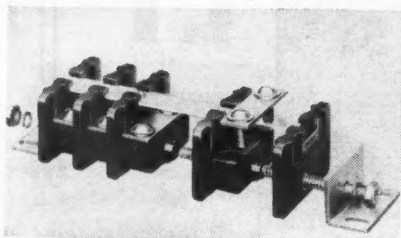
The cross-groove design of the new type GAR ground connector recently developed permits connection of ground bus either parallel to or at right angles to driven rod or pipe. In both applications, type GAR can be slipped over driven rod even if top has been mushroomed, and connection is made secure by tightening two nuts on U-bolt. Current carrying, high copper alloy cast body with silicon bronze U-bolts, nuts and lockwashers permit entire connection to be buried in ground without danger of corrosion. Type GAR can be supplied for all sizes  $\frac{1}{2}$  in. rod through 6 in. I.P.S. and No. 8 sol. through 750 MCM ground conductor. Burndy Engineering Company, 107 Bruckner Blvd., New York 54, N. Y.



### Multi-Breaker

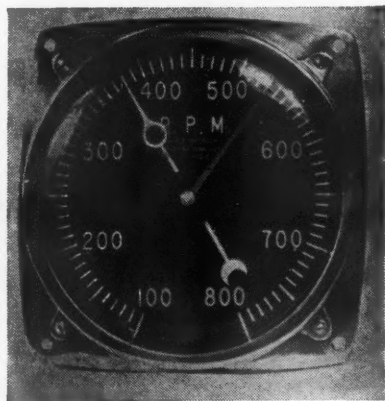
A new 1 and 2 pole multi-breaker suitable for serving lighting appliance and small motor circuits in homes, stores, offices, factories, farms and as service entrance equipment in small dwellings, cottages, and miscellaneous farm and dairy buildings, has been introduced. It features a thermal magnetic trip which provides instant tripping on short circuits but which holds on harmless overloads. The magnetic trip functions in 1/50 to 1/100 of a second, even on minor short circuits. This magnetic trip feature is combined with a thermal bi-metal element which provides time-delayed trip-

ping on moderate overloads. Breakers are furnished in 1947 NEC ratings of 15, 20 and 30 amperes, 120/240 volts, a-c, flush or surface types. They carry Underwriter's approval. Square D Company, Detroit, Mich.



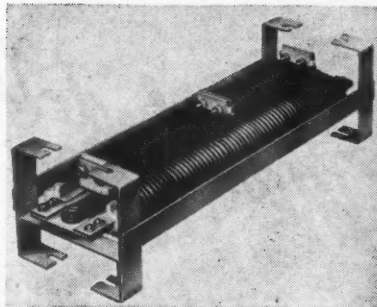
### Terminal Block Kit

A new terminal block kit designed for experimental work and maintenance operations has been introduced. Any number of terminals, from one to 14, can be quickly produced. To repair and maintenance people, this block's flexibility should be useful for replacement purposes. All parts necessary to assemble a wide assortment of terminal blocks, are provided in these kits. Kit No. 200 contains necessary molded sections, terminals and screw assemblies, and Kit No. 201 has a balanced supply of end brackets, partitions, threaded rods, screws, nuts and washers. Curtis Development & Manufacturing Company, 1 North Crawford Avenue, Chicago 24, Ill.



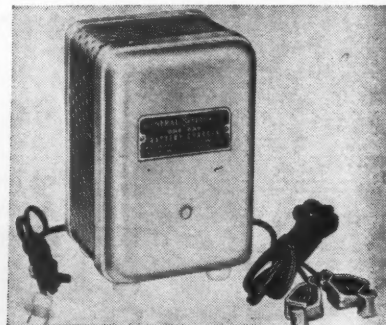
### Instrument

This tachometer with electronic control is available for all industrial and special purposes. It can be used as a safety or control device. By setting the red indicator hand, the maximum speed of the equipment can be controlled. When the predetermined speed is attained, the electronic device actuates a relay that will shut off the equipment, ring a bell, flash a light, or any other operation that is required. Tachometer is of the centrifugal type. Jones Motrola Corporation, 432 Fairfield Avenue, Stamford, Conn.



### Resistors

Edgeohm resistors are applicable for use as starting, dynamic braking, field discharge and plugging resistors on d-c or a-c motor controllers and for other intermittent duty high current applications. These resistors are also suitable for continuous duty uses in load banks; battery charging, welding and plating rheostats and other equipments. Units are rated at 2,200 watts for continuous duty being available with resistances from 0.32 to 4.35 ohms and with continuous current capacities from 21 to 79 amperes. Single resistors are available with stamped steel brackets while multiple units up to four can be furnished in a single open frame. Secondary insulation is provided between the bracket or frame and each resistor unit. Ward Leonard Electric Co., Mount Vernon, N. Y.



### Battery Charger

Two light weight battery chargers that will charge the average run-down battery on the farm or in the home in 24 hours or less have been announced. Known as the "Overnite" and the "One Day", the new selenium rectifier type chargers are constructed so that they may be used without removing the discharged battery from the vehicle during the charging operation. The red-trimmed "Overnite", designed for farm use, will charge the average truck, car or tractor battery in 12 hours or less. The blue-trimmed "One Day" will bring the normally run-down automobile battery up to operating efficiency within 24 hours. The chargers operate on 115 volt, 60 cycle a-c and are connected to the outlet by an eight foot rubber cord. General Electric Company, Bridgeport 2, Conn.

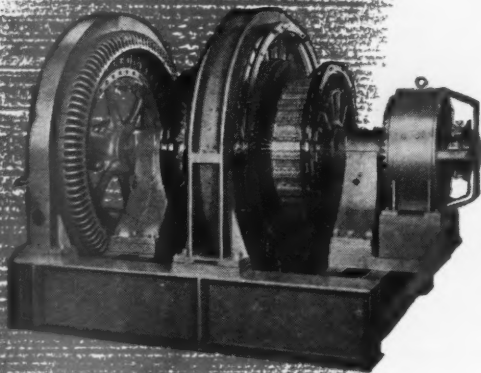


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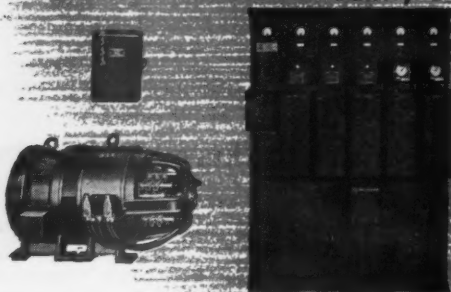
For Electrolytic Processes

● Every piece of EP equipment is designed and built for its specific application. This factor of specialization . . . building-for-the-job, is the reason why The Electric Products Company is the leader in its field. For 35 years, EP has been building High-Current, Low-Voltage Motor-Generators and other special electrical equipment.

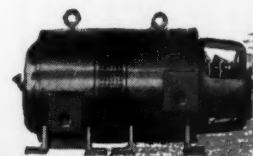
● To You as a user of direct-current in any of its applications, our specialized equipment means savings in life-time cost per unit. It also means more amperes per dollar . . . less electricity consumed. Specially-built equipment requires far less maintenance . . . another saving in time and money.

● Proof of EP superiority is yours for the asking. Descriptive bulletins covering any of the illustrated uses and many other applications are available at no obligation. Your local EP representative will supply you, or a card to The Electric Products Company will secure the same results.

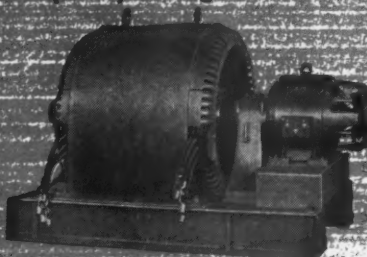
For Industrial Truck Battery Charging



For Standby Battery Charging



Frequency Changers



*also*  
INDUSTRIAL DYNAMOMETERS  
SYNCHRONOUS MOTORS  
AND GENERATORS  
SPECIAL MOTORS  
AND GENERATORS

**EP**

X-34

**THE ELECTRIC PRODUCTS COMPANY**

1734 CLARKSTONE ROAD

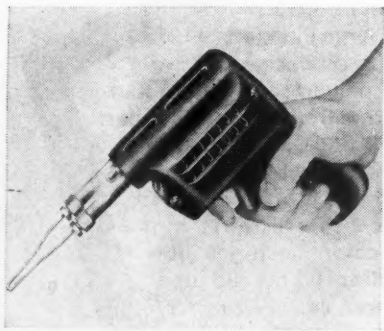
CLEVELAND 12, OHIO





## Motor Control

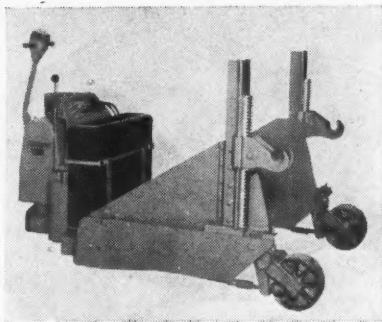
This new magnetic Farmstarter for single phase motors is designed for farm applications and is intended for across-the-line motor starting service. Two models are available with either built-in pushbutton or selector switch control station. The former provides protection against unexpected restarting following a power outage, the latter automatic control by means of time clock, pressure switch, etc. and automatic restarting after power outage. They are available in 3, 5 and 7½ hp. farmstarters for 230 volt service. The 3 and 5 hp. size have dual voltage coils and handle a 1½ and a 3 hp. motor respectively when connected for 115 volt service. Remote control is possible with a separately mounted pushbutton or snap switch. Westinghouse Electric Corp., Pittsburgh 30, Pa.



## Soldering Tool

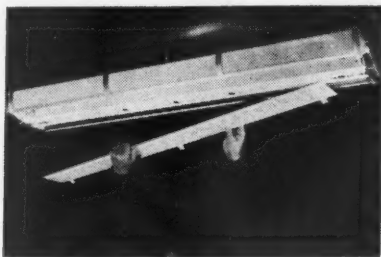
A new soldering tool for the electrical service and maintenance man's kit has been announced. Features of the tool are the tip which may be flexed to suit the work, and the spotlight which keeps the work always in view. The small light, placed between the terminals of the loop tip, goes on automatically when the current is turned on for soldering. It is recommended for work on electrical meter and instrument circuits, electronic equipment, control circuits, small coils and transformers. It may also be used for radio and appliance maintenance, and in motor repair and rewinding shops as well as for laboratory and experimental work. The gun requires 5 seconds for heating. The power is

on only while the gun is in actual use. The tool operates on standard a-c only, 100 watts, 110 volts, 60 cycle current. Two models are available—one with a single heat of 100 watts; the other with dual heat, 100 watts normal heat and 135 watts for short time intermittent use on heavier soldering jobs. Weller Manufacturing Company, 803 Packer St., Easton, Pa.



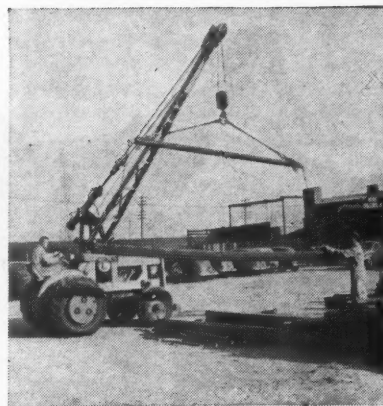
## Electric Industrial Truck

Moving, hauling, storing, winding and unwinding reeled cable, wire or hose becomes a matter of pushbutton control with this new electric industrial truck. New unit is a modified transporter motorized hand truck built to handle up to 6000 pound loads of any commodity wound on spools from three to seven feet in diameter and up to 33 inches in width. Built on standard Transporter drive unit, the reel-handling mechanism consists principally of two features: hooks, adjustable in height for various sized reels and mounted on locking gear racks, in which the reel axle rests; and hinged trailing wheels, which raise the load from the ground. Automatic Transportation Company, 149 West 87th Street, Chicago 20, Ill.



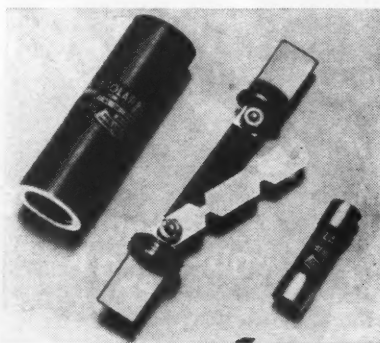
## Fluorescent Unit

The Grenadier, a two lamp semi-direct unit, has been redesigned. The modifications include increased shielding of 35° parallel to the lamps and 25° normal to the lamps. Side panels and louvers are removable for maintenance. Downward component of illumination may be increased by accessory opaque reflectors or by slotted reflectors placed above the lamps. Other improvements include heavier gauge metal, whiter plastic side panels, and a new finish. F. W. Wakefield Brass Co., Vermilion, Ohio.



## Crane

Joshua-Hendy Type U crane is recommended for service to electrical contractors or maintenance departments, for handling heavy transformers, poles, transmission line gear or wire. Mounted on a Model UTI tractor, it can travel wherever a tractor can go. It has a high lifting capacity of from 1½ to 4 tons. The steel boom is raised and lowered by a hydraulic cylinder mounted on the gantry and controlled by a valve at the right of the steering wheel. The three crane controls, swing control, hoist drum control, and boom topping, are located within easy reach of the operator. The tractor has a rear power take-off and pintle hook drawbar at the rear. Industrial Equipment Company, 10911 Russet St., Oakland 3, Calif.



## Fuses

A new line of renewable cartridge fuses, designed for shockproof servicing and rapid renewal, has been announced. The knife blade type fuse has two main parts: a cartridge case with no exposed ferrules or bolts, and a link blade assembly. One end of assembly is sealed to an inner collar on the case by a fibre washer backed by a brass plate; on the other end, a threaded brass plug, permanently fastened to the knife blade assembly, screws inside the casing. Fuses in the ferrule type are equipped with renewable "timed-lag" fuse-links which give protection to equipment and wiring against shorts and overloads. Available in sizes from 3 to 600 amperes, 250 or 600 volts. Carry U.L. approval. Solar Electric Corporation, Warren, Pa.



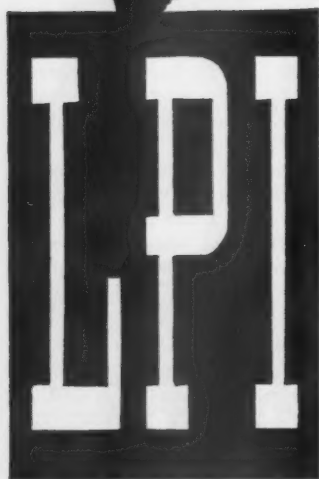


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300 A

Classrooms, too, deserve Planned Lighting, so LPI designers have developed a fluorescent fixture that meets the requirements of the best plans for the best lighting in schools. The LPI EDUCATOR is our new low-cost, high efficiency unit which offers planned lighting assistance to students and teachers. Let the Educator teach you how to get better school lighting at lower cost. Write for our complete catalog



#### LPI EDUCATOR

##### features:

2-40 and 2-100 fixtures with the same cross-sectional width for versatile combinations in continuous runs • Controlled light output—60% downward and 40% upward • No exposed horizontal surfaces to gather dust • Surface or pendent mounting • 35°-45° light cut-off • Heavy, prime steel finished in high temperature "Klasium White".

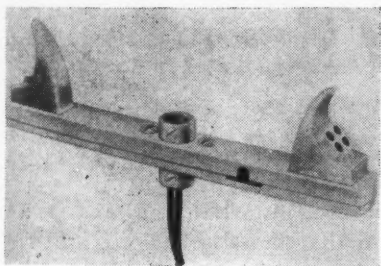
**LIGHTING PRODUCTS, INC.**  
**HIGHLAND PARK, ILLINOIS**





### Instrument

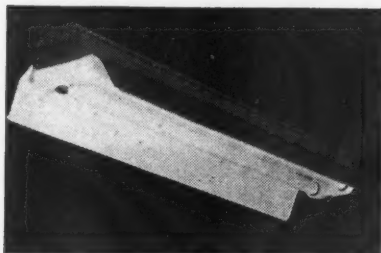
This new curvimeter measures distance by running the instrument along the lines of a blue print or plan. Three scales are available— $\frac{1}{8}$  in. equals 1 foot,  $\frac{1}{4}$  in. equals 1 foot and  $\frac{1}{2}$  in. equals 1 foot. The most commonly used scale,  $\frac{1}{4}$  in. equals 1 foot, is marked in red on the instrument. It registers up to 1200 feet. The  $\frac{1}{8}$  in. scale registers up to 2400 feet. The hands can be reset by pushbutton. One feature is that if a certain distance is erroneously measured the mistake can be rectified by reversing along the line, in which case the hand on the dial moves backward. This instrument is recommended for draftsmen, electrical contractors, industrial designers, heating and plumbing contractors, architects, estimators and draftsmen. The Herman H. Sticht Co., Inc., 27 Park Place, New York 7, N. Y.



### Lampholder

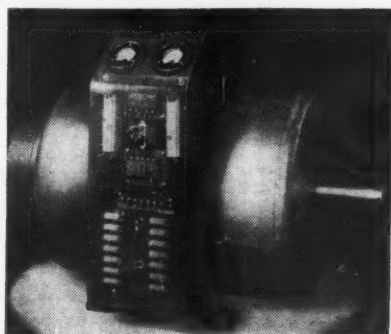
Two new fluorescent lampholders, one for 8 $\frac{1}{2}$  inch Circline lamps, the other for standard lamps have been announced. The Circline holder, illustrated, is designed for use in portable lamps especially, and consists of a white enameled channel with a white plastic lampholder at one end and a white plastic tension support at the other. It is available in two models—either with lamp switch and two 30 inch lead wires; or without switch and with four 30 inch leads. The standard fluorescent lampholder is made of a new high luster white plastic. A heavy reinforced section around the lamp

contact area eliminates cracking or breaking of the lampholder when the lamps are inserted or removed. Three models of the standard holder are available: the single lampholder; the lampholder with black plastic starter socket; and the lampholder with reversed black plastic starter socket. General Electric Company, Bridgeport 2, Conn.



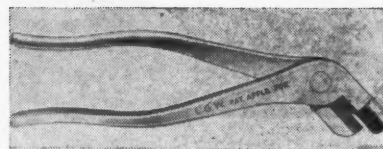
### Fluorescent Fixture

The RD-80 is a new addition to this line of Chan'l-Run industrial fluorescent fixtures. Ballast is internally mounted and it has G-E turret sockets and enlarged wireway for continuous runs. Unit will be furnished with vitreous porcelain enamel reflector, designed to a shielding angle of 14 degrees, a reflectance factor of over 79 percent and an overall efficiency of above 80 percent. Watchdog or No-Blink starters are standard equipment. Holdenline Co., 2301 Scranton Road, Cleveland 13, Ohio.



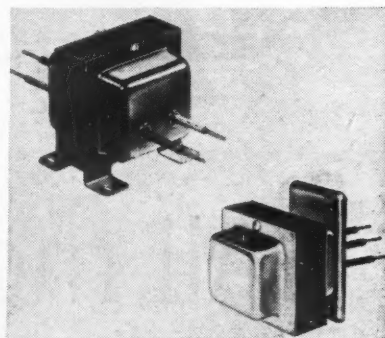
### Generator

This new generator for use in engine-generator sets is a factory-assembled unit including revolving-field generator, direct-connected exciter, automatic voltage regulating circuit, meters and selector switch for pre-setting voltage. The only external connections needed are leads to a generator switch. The built-in automatic voltage regulating circuit has no moving parts and requires no maintenance. 60-cycle ratings at standard voltages and 0.8 power factor include 18.7 kva., 25 kva. and 31.3 kva., 1200 rpm. and 25 kva., 31.3 kva. and 37.5 kva., 1800 rpm. The principle of electrical resonance is used to hold constant voltage. Electric Machinery Mfg. Company, Minneapolis 13, Minn.



### Locknut Pliers

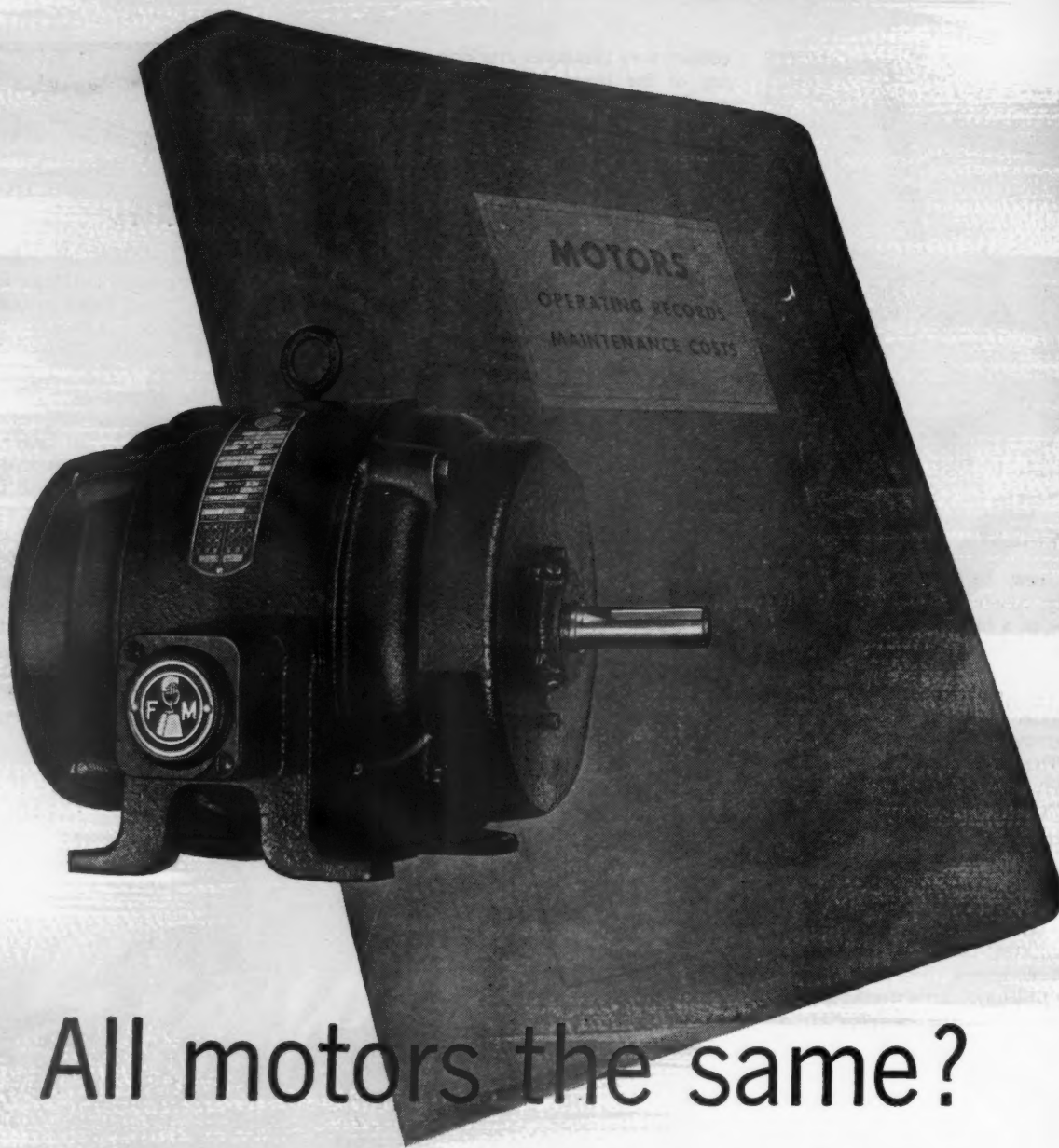
L.G.W. angle locknut pliers will tighten locknuts and bushings in outlet boxes, switch boxes, junction boxes, and panels assuring a permanent grounding system, it is claimed. To tighten locknuts or bushing in boxes, place roller end on inside of pipe or steel tube and lug end over locknut, twist pliers until locknut or bushing is snug against box. They will skin the ends of rubber covered wire No. 14 to No. 8 inclusive. They will remove burrs from steel tube or conduit. To remove burrs on inside ends of conduit or steel tube, place roller on outside with lug end on the inside and make one complete turn. To remove burrs on outside of steel tube so that watertight connectors will go on easily, place roller end on inside and lug end on outside, making one complete turn. White Mfg. Co., 3802 Poe Street, Dallas 4, Texas.



### Transformers

A new line of control and power circuit transformers has been announced. Two general types of units are available—(1) Transformers for operating low voltage devices from 115 volt power circuits. Included is a normal reactance series with 8, 16, 24, and 32 volt secondaries, capacities from 25 to 150 va; also a high reactance series with 25 and 30 volt secondaries, capacities from 20 to 80 va. Units are mounted either with standard shields and mounting feet or with outlet box covers that fit standard round and octagon boxes. (2) Transformers for stepping down from 230, 460, or 575 volt power circuits to supply 115 volt lighting and various supplementary machine tool equipment. Offered in capacities from 25 to 250 va. with standard mounting feet for in-compartment wiring or with rectangular outlet box covers for mounting on FS or FD-type boxes. Capacities from  $\frac{1}{2}$  to 10 kva. Chicago Transformer Division, Essex Wire Corporation, 3501 Addison St., Chicago 18, Ill.





# All motors the same?

## "NO," say men who know them!

MEN whose experience with motors qualifies them to speak with authority will tell you that, beyond similar mounting dimensions and ratings, motors are as different as night and day.

They'll show you records of performance and of maintenance costs which prove that Fairbanks-Morse Motors have remarkable stamina, even on the toughest jobs. This stamina stems from an

exclusive combination of features: indestructible copperspun rotors, pre-wound stators with long-lived insulation, cross-flow ventilation that bans hot spots, and protection against falling objects and dripping liquids, regardless of mounting position.

For full information on motors that do more because they have more, write Fairbanks, Morse & Co., Chicago 5.

## Fairbanks-Morse



*A name worth remembering*

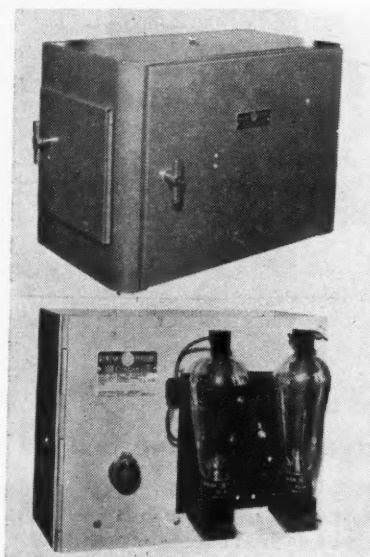
Diesel Locomotives • Diesel Engines • Generators  
Motors • Pumps • Scales • Magnetos • Stokers  
Railroad Motor Cars and Standpipes • Farm Equipment





### Fuse Puller Switch

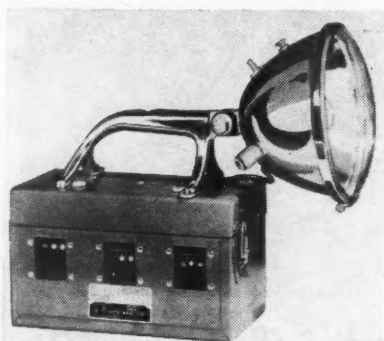
A redesigned line of fuse puller switches, rated at 60 amp., 125/250 volt, a-c has been announced. They measure 9½ in. wide by 14 in. high by 3¼ in. deep. Four different units are available, two of which contain 4 branch circuits, one main, one range circuit and one water heater connection, and two units containing six branch circuits, one main, one range circuit and one water heater connection. The units are wired either in series or parallel. Solderless lugs are provided for wires ranging from No. 14 to No. 4 for the main, range and water heater. A total of 30 knockouts are allowed for grounding bushings. Two special knockouts for use with a ground cable are provided. The main and range circuits take NEC cartridge fuses and the branch circuits take standard plug fuses. The device has a grounded neutral. Trumbull Electric Manufacturing Company, Plainville, Conn.



### Heat Control

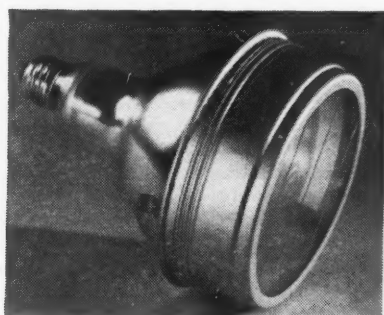
A new phase-shift heat control accessory for resistance welding machines has been announced. It is designed for use with ignitron contactors or non-synchronous control combinations not having the heat control feature, when power supply is 230 or 460 volts. A stepless range of from 20 to 100 percent rms. current is provided by heat control. The control

eliminates the need for multi-tap welding transformers or supply autotransformers, although a welding transformer arranged for series-parallel primary is recommended for very wide heat range. Control panel is enclosed in a steel case suitable for wall mounting or for mounting atop the nonsynchronous control combinations. General Electric Company, Schenectady, N. Y.



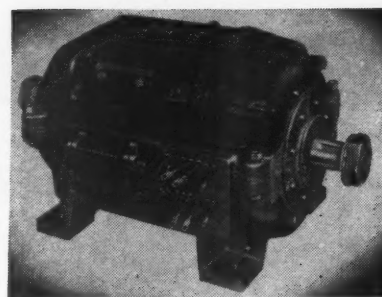
### Electric Hand Lamp

Big Beam Model No. 311 portable rechargeable electric hand lamp throws a 2500 foot beam. With chromium finish head and handle, this lamp has three transparent windows, one for each battery cell. In each window there are three specific gravity ball indicators, one green, one white and one red. When the green ball is down, the battery is 5 percent discharged; white 50 percent discharged; red 95 percent discharged; when fully charged all three balls rise to the water level line. It is unnecessary to remove battery from lamp for recharging as lamp head had receptacle for charger plug-in. U-C Lite Manufacturing Co., 11 E. Hubbard St., Chicago 11, Ill.



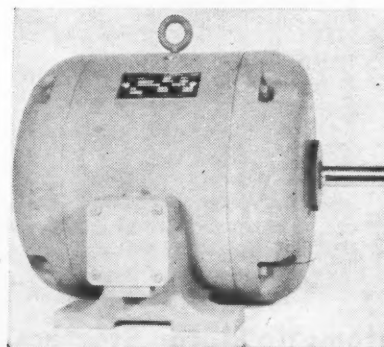
### Colorlighting Accessory

New simple color clips for display and window lighting are now available. The color clip is made of lightweight spun aluminum into which is slipped a round, flat color filter made of natural-color glass segmented in four parts to permit heat escape. Clip and filter slip over any standard reflector bulb to provide spotlighting and floodlighting in any of 17 standard colors. Amplex Corporation, 87 Columbia St., Brooklyn 2, N. Y.



### Mill Motors

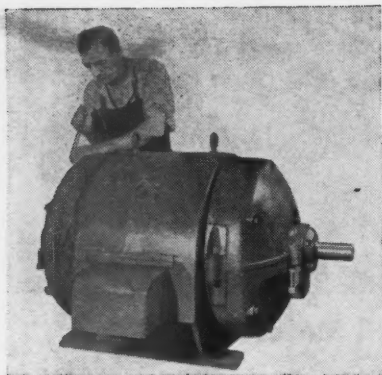
A new line of mill motors reduced one frame size has been announced. A larger armature that fits within the limiting dimensions of the motor frame, new roller bearings and gearing housing, and redesigned field coils make the new motor possible. Heavy duty type MC mill motor is available in totally enclosed, protected self-ventilated or protected force-ventilated construction. Features are split frame of cast steel; silicone insulated armature coil conductors; wedges of Class B material to hold coils in slots; new roller bearing and bearing housing that eliminates need of thrust washer and collars; improved field coil insulation; and rigid mounting of brush holders. It is available in sizes from 5 to 200 hp.; in voltages of 230 and 550, and in AISE dimension frames 602 to 618. Westinghouse Electric Corp., Pittsburgh 30, Pa.



### Totally Enclosed Motors

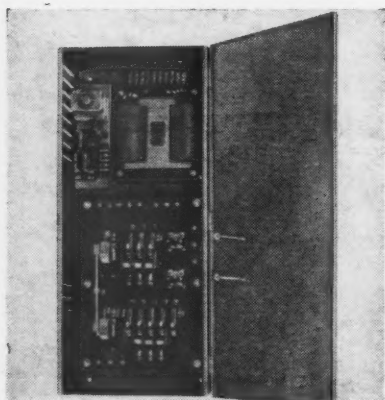
A new series of totally enclosed 3 phase motors has been announced. They are available in sizes of 1½, 2 and 3 hp. The squirrel cage rotor uses rolled sheet copper bars. The rotor is equipped with Norma-Hoffman grease sealed cartridge type bearings. Stator windings are completely submerged in varnish, and each winding is twice baked at moderate temperature until varnish is cured. Holes in mounting feet are spaced in accordance with NEMA. A special cast iron outlet box threaded for proper size of conduit is mounted on side of each motor. Frame and endbells are of cast iron with lifting ring. The Kato Engineering Company, Mankato, Minn.





## Induction Motor

A new two pole squirrel cage induction motor for such high speed applications as boiler feed pumps, oil pipe line pumps, centrifugal pumps, compressors and blowers has been announced. It is rated from 200 to 700 hp. at 3600 rpm; NEMA Class B starting. (Normal torque, low current), favorable for across-the-line starting. Features are Kolene process centrifugally cast bearing sleeves; pressure-lubricated bearings available; slit bearing brackets permit easy access to bearings; windage noise lessened by design to avoid abrupt acceleration of air. Electric Machinery Mfg. Co., Minneapolis 13, Minn.



## Automatic Motor Starters

New Bulletin 4051 a-c automatic motor starters are of the non-reversing auto-transformer type designed for use with single speed two or three phase squirrel cage induction motors driving pumps, fans, M-G sets, compressors and other equipments. The dripproof enclosed starter is arranged in three removable sections—the contactor panel, the timer panel and the multi-tap auto-transformer, providing accessibility to individual components. For ease and simplification of installation all line, load and control terminals are accessible. Adjustable time limit acceleration, overload protection, mechanical and interlock protection and adjustable taps on the autotransformer are provided on starters. Suitable for two wire or three wire control. They are available in

standard sizes for use with squirrel cage induction motors up to and including 100 hp., 550 volts, 60 cycles. Ward Leonard Electric Co., Mount Vernon, N. Y.



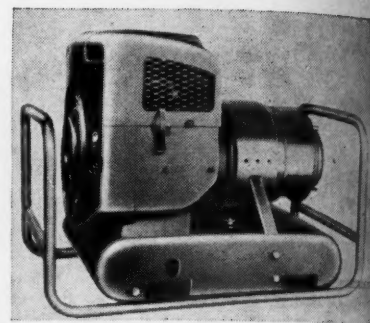
## Earth Drill

A new hydraulically controlled earth drill, Model HBJ, has been developed. It drills 6-in. to 42-in. diameter holes to depths of 10 feet. Steady hydraulic power of the HBJ moves the tower into instant operating position. Other fingertip controls permit adjustment of drill head to a vertical position. All leveling adjustments for either straight holes or anchor holes are hydraulic. It is recommended for pole line construction, pre-boring for piles, foundation hole work, and other jobs which require constant movement of equipment. It is powered by a slow speed 4 cylinder gasoline engine. The engine, together with drilling mechanism, is mounted on an "I" beam of structural steel. A flat-bed truck or a heavy 4 wheel trailer is recommended for mounting. The Buda Company, Harvey, Ill.



## Ballasts

Slimline design ballasts for operation of two 40 watt hot cathode lamps at standard ratings of .39 to .43 amperes have been announced. These ballasts have been approved by Electrical Testing Laboratories, and are especially designed to meet the needs of approved ballasts with streamlined dimensions. Length is 18½ in., height 1½ in., width 2½ in. and mounting holes 17⅞ in. Advance Transformer Company, 1122 W. Catalpa Ave., Chicago 7, Ill.



## Electric Plants

A 5000 watt electric plant, known as the 5CK-115M, has been announced. It is one of a new, improved group of plants employing the new "CK" air-cooled, 4 cycle, two cylinder gasoline engine as a prime mover. They produce about 1 kilowatt hour of electricity per quart of gasoline. They are designed for portability with aluminum construction in either a-c or d-c types. Standard equipment for the manual starting models includes a protective guard frame and convenient 4 receptacle outlet box for direct plug-in of loads. Plants are available in 60 or 50 cycle a-c, 2,000 and 3,000 watts, and d-c 5,000 watts and 3,500 watt battery charger, in stationary or portable types, with either manual or electric starting. D. W. Onan & Sons, Inc., Minneapolis 5, Minn.



## Haymow Lighting Fixture

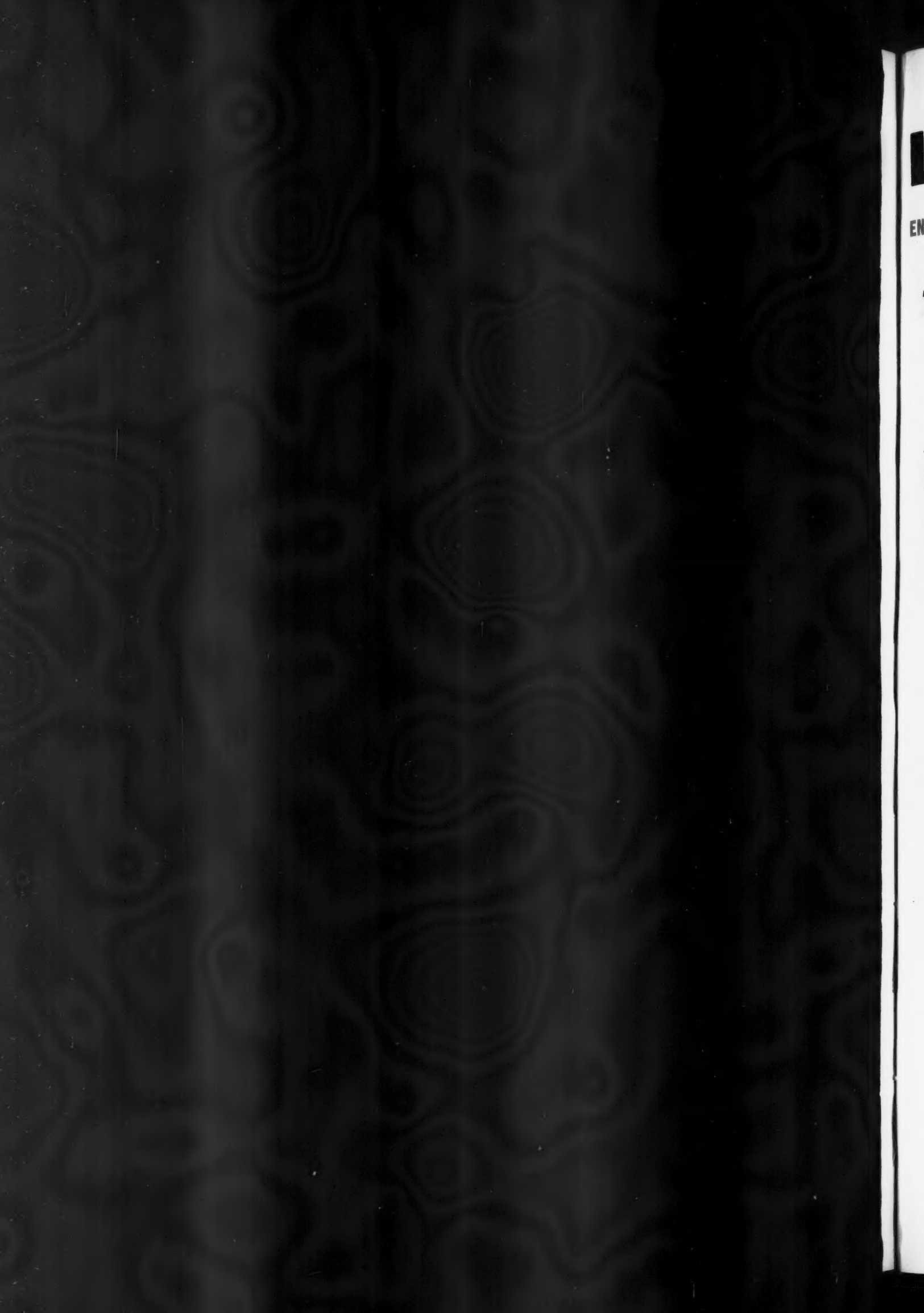
This dust and vapor proof lighting fixture is designed for use in such hazardous locations as barns, chicken houses, grain warehouses, etc., where the 1947 National Electrical Code does not require the special fittings covered by Article 500. It has bakelite cover, socket and globe holder. Glass globe, standard wide mouth one quart fruit jar, which can be easily replaced. When installed fixture is entirely insulated. Recommended for use with 60 watt lamp. Mounting holes fit standard 3½ in. and 4 in. octagon outlet boxes. Union Insulating Co., Inc., Parkersburg, W. Va.



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# Industrial Electrification

ENGINEERING • INSTALLATION • MAINTENANCE

## The Use of Capacitors in Industrial Plants—Part II

What is meant by the expression "release system capacity"? When capacitors are operating on a system they deliver kilovars, furnishing magnetizing current for motors, transformers, etc., thus reducing the current from the power supply. Less current means less kva. or load on transformers, and main and branch feeder circuits. This means capacitors can be used to reduce overloading of existing equipment, or if the equipment is not overloaded, additional load can be added.

Fig. 1 shows why capacitors are becoming more and more the economical answer for releasing system capacity and reducing power costs. Prices of capacitors have decreased while prices of most other equipments have increased the last few years.

Fig. 2 shows (1) the percent system capacity released by power factor improvement, and, (2) whether or not it is economical to obtain system capacity by power factor improvement.

Whether or not it is economical to obtain additional system capacity by capacitors depends upon the initial and improved power factor of the load and the cost relationship (S/C) between new substation and distribution facilities (S) and the cost of capacitors (C). The costs should be on installed basis for a true comparison.

Where actual installed cost data are not available, the following, which are representative for optimum size load-center installations (the load-center system is the most economical method of power distribution) may be used:

Installed Costs			
(S) Substation and Distribution Facilities		(C) Capacitors	
Volt- age	\$/kva. (1)	\$/kvar. (2)	S/C
230	\$30 -35	\$18	1.7-2
460	\$20 -25	\$9	2.2-2.8
575	\$17.5-22.5	\$9	2 -2.5

W. C. Bloomquist  
Industrial Power Division  
General Electric Company  
Schenectady, N. Y.

- (1) Installed cost of load-center system including primary and secondary switchgear, primary and secondary cable, and transformer.
- (2) Installed cost of capacitors with a manually operated switching device.

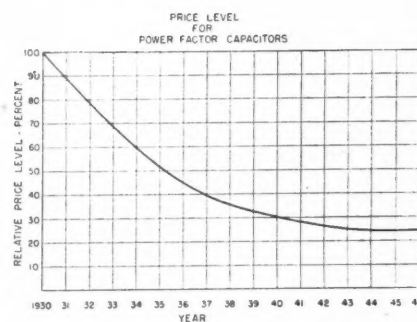
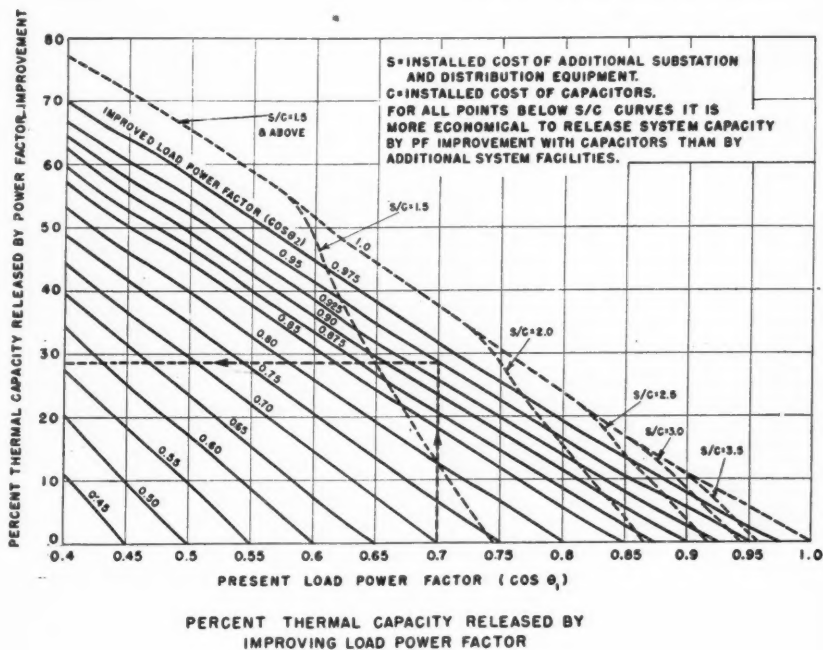


FIG. 1—Price level of capacitors.



### EXAMPLE

IF THE LOAD POWER FACTOR OF A SUBSTATION IS IMPROVED FROM 70 TO 95 PERCENT, THE SYSTEM CAPACITY RELEASED IS 26.5 PERCENT; THAT IS, THE SYSTEM CAN CARRY 26.5 PERCENT MORE LOAD (AT 70 PERCENT POWER FACTOR) WITHOUT EXCEEDING THE NET KVA BEFORE THE POWER FACTOR WAS IMPROVED.

THIS CURVE ALSO SHOWS THAT IT IS MORE ECONOMICAL TO OBTAIN THIS AMOUNT OF SYSTEM CAPACITY BY POWER FACTOR IMPROVEMENT WITH CAPACITORS THAN PURCHASING ADDITIONAL SUBSTATION AND DISTRIBUTION FACILITIES FOR ALL S/C VALUES ABOVE 1.6 (OBTAINED BY INTERPOLATION).

FIG. 2—Percent system capacity released by improvement in load power factor.



When the substation capacity is small, i.e., below 500 kva. for 460- and 575-volt service, the installed system cost may be even higher than given above because some costs are practically independent of substation rating.

#### Example (3)

Substation rating 500 kva. and operated at full load.

Present power factor 70 percent.

Present average kilowatt load =  $0.7 \times 500 = 350$  kw.

System voltage 460 volts.

(1) How much system capacity is released if the power factor is improved from 70 to 95 percent?

From Fig. 2 it is found that improving the power factor from 70 to 95 percent releases 28.5 percent capacity, i.e., a 99.8 kw. load ( $0.285 \times 350 = 99.8$  kw.) at the original 70 percent power factor can be added without increasing the load on the 500-kva. substation, or, in terms of kva., this is  $0.285 \times 500 = 142.5$  kva.

(2) Is it economical to use capacitors for this purpose?

Release of system capacity by power factor improvement with capacitors is more economical than by additional substation and distribution facilities for all values below the S/C curves shown in Fig. 2.

Assume new substation and distribution facilities cost \$20/kva. and the capacitor equipment \$9/kvar. installed. The S/C ratio is  $20/9 = 2.2$ .

From Fig. 2 it is seen that the intersection of the 0.7 and 0.95 power factor

points is below  $S/C = 2.2$ . Therefore, the capacitor method is more economical.

This can be checked in actual dollars as follows:

The amount of capacitors required to improve the power factor from 70 to 95 percent = Factor  $\times$  Kw. =  $(0.691) \times 350 = 242$  kvar. The factor (0.691) is read from Fig. 3.

Capacitor cost, installed =  $242 \times \$9 = \$2,178$ .

Substation capacity released = 142.5 kva.

Installed cost of substation and distribution facilities =  $142.5 \times \$20 = \$2,850$ .

In this example, the cost of additional system capacity by use of capacitors cost only three-fourths as much as new substation and distribution facilities.

#### Example (2)

**Problem**—A small machine manufacturer found his 225-kva. power transformer bank badly overloaded and the voltage on some of the 440-volt feeders too low for good operation of the electrical equipment.

**Solution**—The practical and economical solution was capacitors, two 60-kvar., 460-volt small rack type equipments located on the two largest feeders and near the load areas. Other methods were considered, such as installing an additional transformer bank and additional feeders, but these could not be economically justified and such equipment could not be obtained soon enough for immediate relief.

Here is why capacitors were used

	Before Capacitors	After Capacitors
Peak load on 225 kva. transformer bank	305 kva.	220 kva.
Average monthly power factor	71.5%	95.4%
Voltage improvement		13 to 20 v.
Saving in power costs		\$940 per yr.

The saving in power cost due to the improved power factor with capacitors averages \$940 per year. The installed cost of the capacitors, including switches and wiring, was \$1050. The annual gross return on the capacitor investment due to savings in power bill alone is approximately 90 percent. In this case, capacitors served the dual purpose of reducing overload and power costs.

Not only can capacitors be used economically to release capacity of existing facilities but, for low load power factor, it is economical to use capacitors in new installations. This fact was recognized during the war and many of the plants incorporated

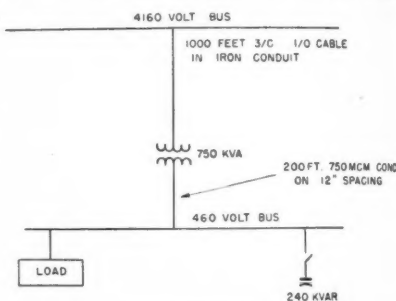


FIG. 4—Circuit arrangement and data for Example 3.

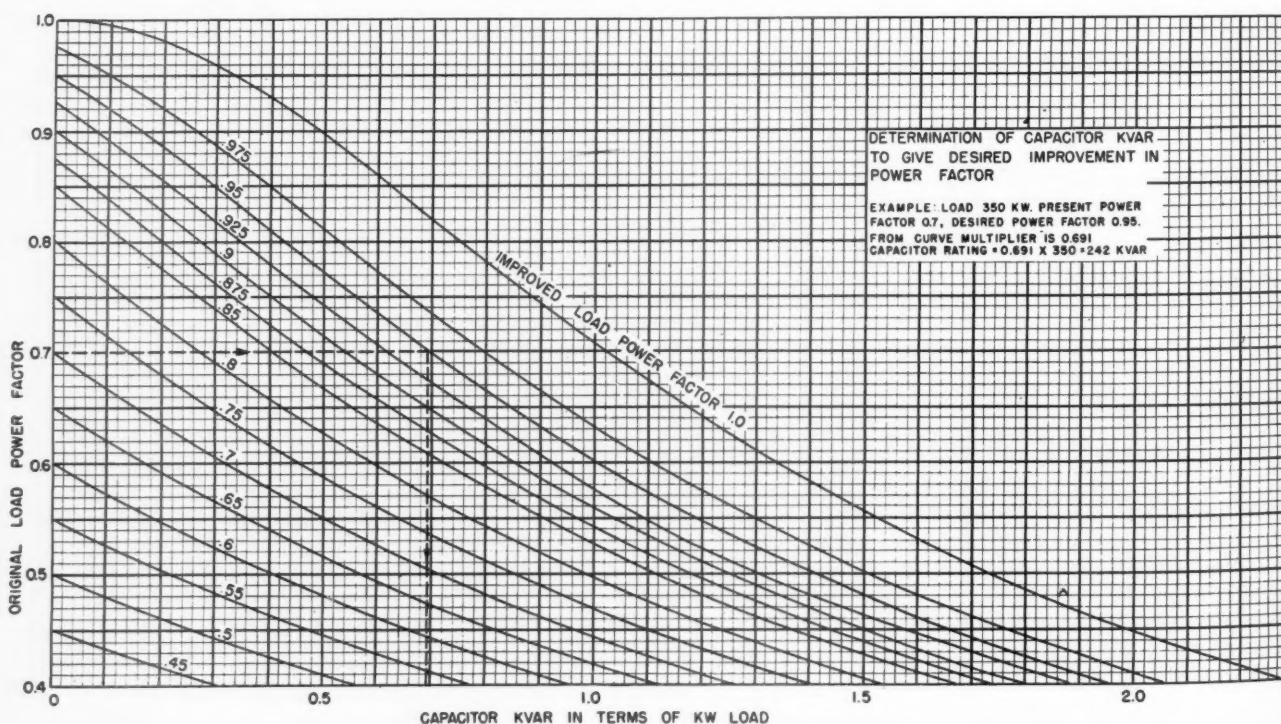


FIG. 3—Chart for determining capacitor kvar. required to give desired improvement in power factor.



capacitors as part of the power system design.

# REDUCTION IN SYSTEM LOSSES BY POWER FACTOR IMPROVEMENT

Industrial plants do not buy capacitors for the saving in system losses alone. The saving in system losses may be considered as an *additional* reason for using capacitors.

System losses are proportional to current squared ( $I^2$ ) and since the current is reduced in direct proportion to the improvement in power factor, the losses are inversely proportional to power factor squared ( $PF^2$ ). For example, if the power factor is improved from 70 to 95 percent the losses at 95 percent power factor are only  $(70/95)^2 \times 100$  or 54.3 percent of the losses at 70 percent power factor.

If capacitors could be distributed and applied to every load on the system, full benefit of loss reduction could be realized. However, it is generally uneconomical and impractical to apply capacitors in that manner so full realization in reduction of system losses is not possible.

Losses in the power distribution system in industrial plants vary but are in the order of 2.5 to 7.5 percent of the total kw-hrs., and depend upon the load power factor, hours of full load and no load plant operation, the wire size, and the length of main and branch feeder circuits. Studies have shown

TABLE I: REACTANCE FACTORS FOR TYPICAL CABLE CIRCUITS  
"RF" FACTOR<sup>(1)</sup>

System Voltage.....	230	460	575	2400	4160	6900	13800
<b>Cable Size, No. 4 to No. 1</b>							
3-1/C Cables in iron conduit	98.3	24.6	15.74	1.075	0.358	—	—
3/C Cable in iron conduit or interlocked armored cable	71.8	18	11.5	0.669	0.222	0.11	0.0276
3/C Cable in non-magnetic duct	58.5	14.7	9.4	0.581	0.194	0.0955	0.024
<b>Cable Size, 1/0 to 4/0</b>							
3-1/C Cables in iron conduit	92.5	23.2	14.85	0.955	0.318	—	—
3/C Cable in iron conduit or interlocked armored cable	68	17.1	10.9	0.6	0.2	0.0943	0.0237
3/C Cable in non-magnetic duct	54.8	13.72	8.8	0.52	0.173	0.018	0.0205
<b>Cable Size, 250 MCM to 750 MCM</b>							
3-1/C Cables in iron conduit	85	21.3	13.63	0.868	0.289	—	—
3/C Cable in iron conduit or interlocked armored cable	61.4	15.4	9.85	0.538	0.179	0.0796	0.02
3/C Cable in non-magnetic duct	51	12.8	8.19	0.477	0.159	0.07	0.0176

<sup>(1)</sup>These factors apply to 3-phase circuits. For single-phase circuits, multiply these values by two. These "RF" factors are also equal to the per cent reactance of 1000 circuit feet on a 1000-kva base.

TABLE II: APPROXIMATE PER CENT REACTANCE OF TRANSFORMERS<sup>(1)</sup>

Power Transformers above 500 kva	
Voltage	Reactance (X)
Up to 23 kv	6.0%
34.5 kv	6.5%
46 kv	7.0%
69 kv	7.5%
Distribution-type Transformers up to 15 kv	
Rating	Reactance (X)
Up to 15 kva	2.0%
25-50 kva	2.5%
75-200 kva	4.0%

<sup>(1)</sup>Transformer reactance values are on transformer base kva.

TABLE IV: REACTANCE FACTORS FOR TYPICAL LOW VOLTAGE BUSWAY CIRCUITS<sup>(1)</sup>  
"RF" FACTOR

	SYSTEM VOLTAGE		
	230	460	575
<b>Plug-in Busways</b>			
Up to 600 amp rating	94.5	23.7	15.2
601 to 1000 amp rating	47.2	11.8	7.6
<b>Low Impedance Feeder Busways</b>			
Up to 600 amp rating	45.3	11.4	7.3
601 to 1000 amp rating	17.8	4.45	2.95
1600 to 2000 amp rating	7.55	1.9	1.21

<sup>(1)</sup>For 3-phase circuits only. These "RF" factors are also equal to the per cent reactance of 1000 circuit feet on a 1000-kva base.

TABLE III: REACTANCE FACTORS FOR TYPICAL MEDIUM- AND LOW-VOLTAGE DISTRIBUTION SYSTEMS "RF" FACTOR<sup>(1)</sup>

System Voltage.....	230			460			575			2400	4160	6900	13800
Equivalent delta spacing.....	6"	12"	18"	6"	12"	18"	6"	12"	18"	30"	30"	36"	42"
<b>Wire Sizes</b>													
No. 4 to No. 1	180	208	223	45	52.1	56	28.8	33.3	35.8	2.29	0.762	0.286	0.073
1/0 to 250 MCM	155	185	202	38.8	46.5	50.7	24.8	29.7	32.4	2.06	0.688	0.258	0.067
300 MCM to 750 MCM	134.1	163	180	33.6	40.8	45	21.5	26.1	28.8	1.87	0.625	0.235	0.061

<sup>(1)</sup>These factors apply to 3-phase circuits. For single-phase circuits, multiply these values by two. These "RF" factors are also equal to the per cent reactance of 1000 circuit feet on a 1000-kva base.



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that the reduction in plant losses due to power factor improvement results in an annual gross rate of return up to 15 percent on the capacitor investment; if the power bill has a kilowatt demand charge, the kilowatt demand will be reduced by the reduction in losses resulting in an additional saving in the power cost.

**CAPACITORS RAISE SYSTEM VOLTAGE**

In industrial plants it is rarely economical to use capacitors for voltage improvement only. Voltage improvement can be generally considered as an *additional* benefit of capacitors.

The greatest gain in voltage improvement will be in plant distribution circuits having high reactance and low voltage, such as is true of 230-volt systems having old-style feeder construction where the wires between phases are spaced far apart. Where the load center principle of distribution is used for modern 460- and 575-volt systems, the voltage improvement will be small.

There is some misunderstanding regarding voltage *regulation* when capacitors are used. Capacitors do not reduce the voltage regulation unless they are switched. The system voltage regulation with unswitched capacitors is practically the same as without capacitors, but the voltage *level* is raised.

The voltage rise due to capacitors in industrial plants with modern power distribution systems is not very great and is rarely more than four or five percent, at the most.

Although it is well known that switching capacitors in and out of service changes the system voltage level, it is not commonly appreciated that the voltage change is due almost entirely to the effect of the capacitor current on the system reactance alone. Therefore, it is only necessary to know the capacitor rating and system reactance to determine the approximate voltage change occasioned by switching a block of capacitors.

There are many methods for determining the voltage change due to switching capacitors on and off the system, but the concept of converting ohmic values to percent on a selected common base is perhaps the most practical.

**Useful Formulas**

$$\text{Percent } V_e = \frac{\text{Kvar.} \times (\text{Percent } X_b)}{\text{Base kva.}} \quad (1)$$

$$\text{Percent } V_e = \frac{\text{Kvar.} \times (RF) \times (l)}{1,000,000} \quad (2)$$

$$\text{Percent Ohms} = \frac{\text{Actual ohms} \times \text{Base kva.}}{10 \times KV} \quad (3)$$

To change percent reactance values on a given base kva. to the selected base kva.

$$\text{Percent } X_b = \frac{\text{Base kva.} \times (\text{Percent } X_1)}{\text{kva.}_1} \quad (4)$$

$$\text{Percent system impedance} \quad \text{Percent } Z = \frac{\text{Base kva.} \times 100 \text{ Percent}}{\text{System short-circuit kva.}} \quad (5)$$

**Nomenclature**

Percent  $V_e$  = Percent voltage change due to capacitors

Kvar. = Capacitor rating in kilovars

Base kva. = Kva. selected for base calculations

Kva.<sub>1</sub> = Kva. rating of equipment, such as a transformer

Percent  $X_b$  = Percent reactance of equipment, such as that of transformer, on selected common base

Percent  $X_1$  = Percent reactance of equipment, such as that of a transformer, on its own kva. rating

Percent  $Z$  = Percent system impedance referred to selected base kva.

RF = Reactance Factor (Tables I, II, III, and IV)

$l$  = Length of circuit in feet

KV = Line-to-line kilovolts

It should be noted that the reactance factor "RF" as given in tables I, III and IV is also the *percent reactance for 1000 feet on a 1000-kva. base*, and can, therefore, be used directly in the percent method of calculations.

**Example (3)**

Determine the voltage change occasioned by switching capacitors in blocks of 240 kvar. for the data of Fig. 4.

Select 1000 kva. as the common base and refer all percent reactance values to this base.

Obtain Percent  $X$  of the primary cable circuit. From Table I, the "RF" factor (and also Percent  $X$  on 1000 kva. base, the base selected) is 0.2 percent.

The reactance of the transformer is found from Table II to be 6 percent. However, this 6 percent is on a base of 750 kva. and must be converted to the selected base of 1000 kva.

From Formula (4)

$$\text{Percent } X_b = \frac{1000}{750} \times 6 \text{ percent} = 8 \text{ percent}$$

The reactance of the 460-volt secondary line is 40.8 percent as read from Table III. This is for 1000 feet, however, while the actual length of this line is 200 feet.

$$\text{Then Percent } X = \frac{200}{1000} \times 40.8 = 8.16 \text{ percent}$$

The total reactance of the components is:  $0.2 + 8 + 8.16 = 16.36$  percent.

From Formula (1) the voltage change due to switching to 240 kvar. of capacitors is

$$\text{Percent } V_e = \frac{240}{1000} \times 16.36 \text{ percent} = 3.84 \text{ percent}$$





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# DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

I-5

## Specifications for Rewinding a-c Induction Motors with Silicone Insulation.

Note: For four years, silicone-insulated test motors have been operated at temperatures of 240 to 310 degrees C. (464 to 590 degrees F.) and periodically exposed to 100 percent humidity to check the condition of the insulation. These tests have proven that silicone insulation will withstand 100 degrees C. more heat and have at least 10 times the wet insulation resistance of the best electrical insulation previously known. Service records show that silicone insulation has at least 10 times the life of mica-glass insulation bonded and impregnated with conventional organic varnishes. The Dow Corning Corporation has prepared the following specifications for rewinding induction motors with silicone insulation, listing all of the materials necessary for maximum service life of motors.

### A. MATERIAL AND WORKMANSHIP:

**A-1. Materials.** Only inorganic materials (glass, mica, asbestos, etc.) bonded and/or impregnated with silicone resins, shall be used.

**A-2. Workmanship.** These motors shall be rewound and processed in a careful and workmanlike manner in accordance with good practice.

### B. REQUIREMENTS:

**B-1. Magnet Wire.** The coils of these motors shall be made of glass served silicone bonded magnet wire.

**B-2. Ground Insulation or slot liners.** A glass-mica, or a glass-mica-glass composite bonded together with silicone resins, shall be used for ground insulation.

**B-3. Coil Separators.** A glass-mica or a glass-mica-glass composite bonded together with a silicone resin; or a glass-silicone laminate shall be used for coil separators.

**B-4. Phase Separators.** Silicone varnished glass cloth, a glass-mica, or a glass-mica-glass composite bonded together with a silicone resin, shall be used for phase separator.

**B-5. Tape.** Silicone varnished glass tape, or untreated glass tape shall be used.

**B-6. Tying Cord.** Only silicone impregnated or untreated glass sleeving or glass typing cord shall be used.

**B-7. Sleeving.** Only silicone varnished or untreated glass sleeving shall be used.

**B-8. Slot wedges.** The slot wedges shall be made of glass-silicone laminate.

**B-9. Coil Connections.** All coil connections or joints shall be made by brazing or by soldering with SilFos, Phos-Copper, or with other solders whose softening point is over 285°C.

**B-10. Coil Supports, Coil Wedges, Mechanical Supports.** All items used for mechanical blocking shall consist of laminated or molded glass-silicone or asbestos-silicone materials.

**B-11. Lead Wire.** The lead wire shall consist of a stranded extra flexible copper wire insulated with silicone rubber and covered with a glass braid.

**B-12. Impregnating Varnish.** The impregnating varnish shall be silicone varnish. Two or more coats of varnish shall be applied and baked in accordance with the varnish manufacturers' recommendations.

**B-13. Potting or Calking Compound.** The potting compound used to cement the motor leads in the motor terminal chamber shall be silicone rubber compound.

**B-14. Ball Bearing Lubricant.** The ball bearings and the ball bearing cartridges shall be thoroughly cleaned of all old lubricant and relubricated with silicone lubricant.

**B-15. Paint or Enamel.** The outside of the motor should be painted with a silicone machinery enamel which shall be capable of withstanding continuous operation at 200°C.

**B-16. All Other Components.** Any other necessary components shall consist of silicone glass or silicone glass-mica combinations or any other inorganic material capable of withstanding 200°C. continuously.

**B-17. Caution.** No organic materials such as friction, tape, scotch tape, organic sticking varnish, cotton typing cord, paper, etc., shall be used.

Above specifications recommended by Dow Corning Corporation. Prepared by  
Clayton Doremire, Technical Sales Service and Development Engineer.



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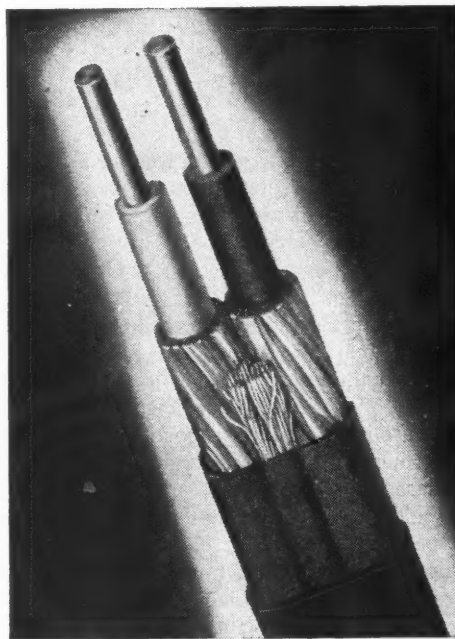
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# Reader's Quiz

## Recording Watt-Hour Meter

**Q** UESTION 260—We use in our testing work a 3 phase, 4 wire, 120/208 volt recording watt-hour meter.

This instrument has two rotating elements both on the same shaft. There are only two potential coils which are connected between phases A and C and the neutral. There are four current coils, two on each rotating element. Phases A and C pass through one coil each and phase B passes through one coil in each element in series.

I would like to have some of your readers explain how this records the correct wattage on a three phase four wire system.—E.M.

**A.** TO QUESTION 260—The two element four wire split coil meter as illustrated in Fig. (a) may be used to record three phase power where the voltages are balanced. Under these conditions the negative vectorial sum of phase voltages A and C equals phase voltage B.

Thus  $E_B = -(E_A + E_C)$

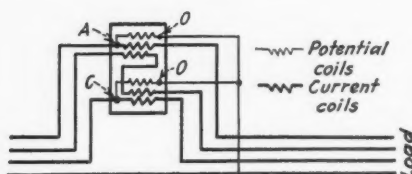
Referring to Fig. (a) it will be noted that in the top element a torque will be produced proportional to the product of the current and voltage of phase A. In the lower element the torque produced will be proportional to the product of the current and voltage of phase C.

In addition an increment of torque will be produced in each element proportional to the product of phase B current and the particular phase voltage on that element. Since the power in phase B may be shown as:

$$P_B = I_B E_B$$

Then  $P_B$  also is proportional to  $I_B (E_A + E_C)$ . Hence the two increments combine to indicate the power being taken from phase B.

On the shaft of a two element split coil meter, therefore, we have the equivalent of three torques acting to



indicate the wattage drawn from each of the three phases.

On systems where the phase voltages are considerably unbalanced a three element meter should be used.—R.W.D.

**A.** TO QUESTION 260—The recording watt-hour meter registers in direct ratio to the sum of the torques acting on the meter elements, which in turn is equal to the product of the current in the current coils times the voltage in the potential coils times the cosine of the vectorial angle between the two.

The meter in question has a current coil and a potential coil on phase A acting on element #1, which would give the total watthours for that phase— $(E_A I_A \cos \phi_A)$ .

It has a current coil and a potential coil on phase C acting on element No. 2, which would give the total watts for that phase— $E_C I_C \cos \phi_C$ .

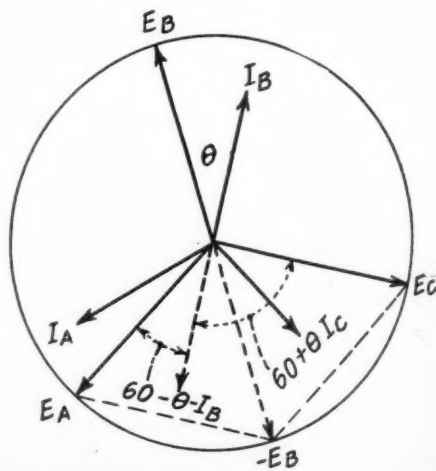
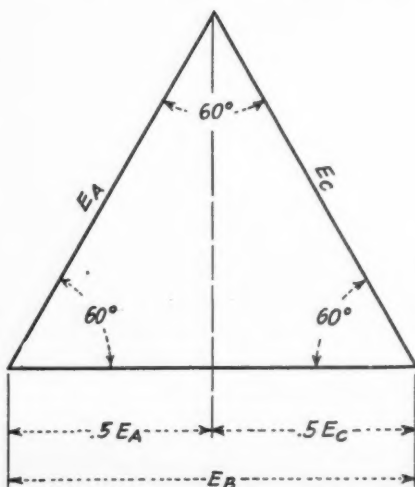
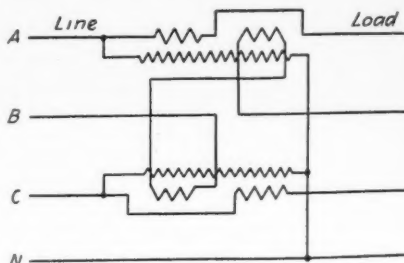
It has two current coils in phase B. One acts on element No. 1, in conjunction with potential "A" which is  $60^\circ$  out of phase with current B at unity power factor of load, so that

element No. 1 would measure  $E_A I_B \cos 60^\circ = E_A I_B \times .5 = .5 E_A I_B$ . The other current coil on phase B acts on element No. 2 in conjunction with voltage  $E_C$  which is  $60^\circ$  out of phase with  $I_B$  at unity P. F. load, so that element #2 would measure  $E_C I_B \cos 60^\circ = .5 E_C I_B$ . The total torque due to current  $I_B$  through the two coils would therefore be:

$.5 E_A I_B + .5 E_C I_B = I_B (.5 E_A + .5 E_C)$ ; but  $.5 E_A + .5 E_C = E_B$  (See sketch.) Therefore, the torque exerted by  $I_B$  through the two coils is  $E_B I_B \cos \phi_B$ , which is the correct wattage of that phase.

As seen from the above, the meter will measure accurately only if the voltages are balanced, that is, when  $E_A = E_B = E_C$ . A small unbalance will not affect the accuracy enough to make any difference as far as practical use is concerned.—M.N.H.

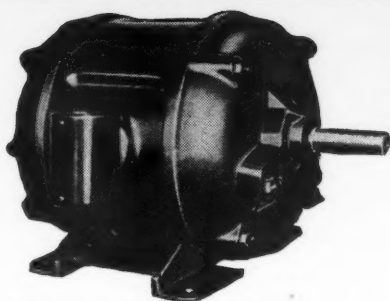
**A.** TO QUESTION 260—The Blondel theorem requires three metering elements to measure correctly, for all conditions, the power de-





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*help Industry maintain  
Peak Production*



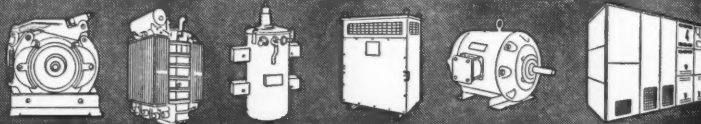
Regardless of what your motor requirements may be—large motors...small motors... Wagner makes them all. The motor illustrated is typical of the Wagner line of polyphase and single-phase motors. Choose a Wagner motor for your next installation.

Whistles blow, workers stop, and new shifts come on to the job, but motors driving production equipment must whirl merrily on around the clock to help industry maintain peak production. And peak production can be maintained only if motors stay on the job without breakdowns. Dependable motor performance is a tough assignment—but not so tough for Wagner Motors. They have the stamina to stand up because they are made of highest quality materials and are

engineered to do the job efficiently. If you want motors that *will* do the job, whether large or small, contact any of our twenty-nine branches. They are located in principal cities and manned by trained field engineers who will help you solve your motor problems. A letter addressed to Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo., will bring Bulletins on the complete line of Wagner Quality Motors.

**Wagner**  
Electric Corporation  
EST. 1891

*Consult Wagner Engineers on all Electric Motor Problems*



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

**ELECTRICAL AND AUTOMOTIVE PRODUCTS**



# Stock and Sell

## JOHNSON ELECTRIC MOTOR BEARINGS



Distributors of Johnson Electric Motor Bearings make real profits . . . give excellent service. Reasonably good stocks of over 250 individual types are now available. Write for our NEW catalogue and details regarding our franchise.

**JOHNSON** **BRONZE**  
SLEEVE BEARING HEADQUARTERS  
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### ONE OF MANY *Superior Brush* ASSORTMENTS AVAILABLE FOR YOUR CONVENIENCE...

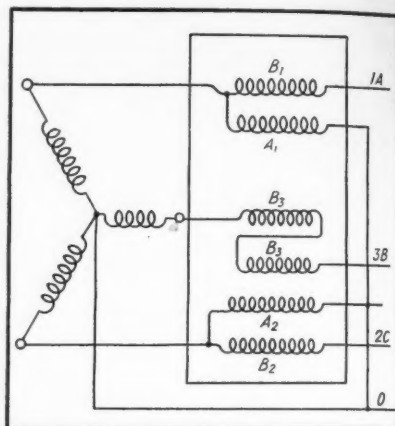
Our No. 124 Assortment is a wonderfully handy selection of exactly 124 representative Superior Carbon Brushes for fractional horsepower motors—Century, Delco, Wagner, Westinghouse—practically all popular makes. Every brush embodies Superior quality (28 years' background) at its best.



**SUPERIOR CARBON PRODUCTS CO.**  
9113 GEORGE AVENUE • CLEVELAND 5, OHIO  
**SUPERIOR CARBON BRUSHES**  
Since 1919

livered by a three phase four-wire system in which the fourth wire is the neutral. With the meter connected as shown, that is, with the current coils inserted in the wire from which no potential tap is taken and wound in the reverse direction from those connected in the other two wires, the effect of this reversal is to reverse the vector  $I_b$  so that it makes an angle of  $(60-\theta)$  with  $E_a$  and  $(60+\theta)$  with  $E_c$ . The reversed current  $I_b$  reacts with  $E_a$  and  $E_c$  to produce torque the same as it would produce with  $E_b$  in the third element if present. Since the sum of the line voltages must always equal zero, the sum of  $E_a$  and  $E_c$  regardless of magnitude equals  $E_b$ . Thus, correct registration is obtained.—R.H.E.

**A.** TO QUESTION 260—With reference to diagram: This instrument employs two potential elements, A1 and A2 connected from phase A and phase C respectively to



the neutral (0). There are four current coils, one B1 in phase A, one B2 in phase C and two (B3, B3) in phase B. Each potential coil is acted on by two current coils, one in the line wire to which the potential coil is connected and one in the third line wire, to which neither potential coil is connected.

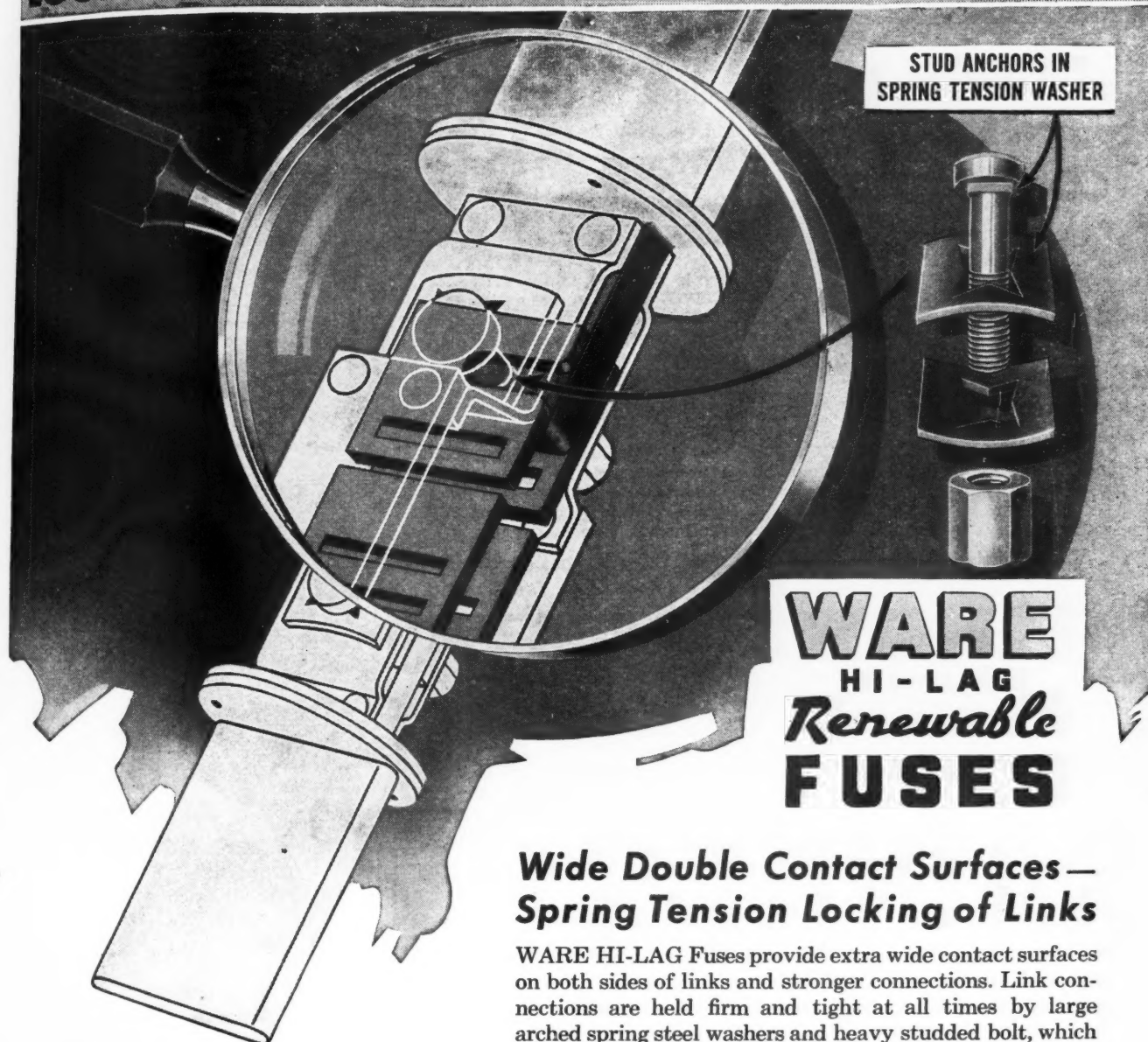
As the voltage of the two phase A & C which contain the potential coils are displaced  $120^\circ$  from each other and also from the third phase B their resultant will be equal and opposite to the voltage of the third phase and consequently their combined effect on the two current coils in the third line wire phase (B) will be the same as the voltage of the 3rd phase B would have if it acted directly on one current coil, that is provided the coils are correctly connected for polarity.

These meters are accurate on any power factor, but only on BALANCED VOLTAGES.—H.T.V.

**A.** TO QUESTION 260—In the watt-hour meter you mention phases A and C record as two single



## LOOK TO WARE HI-LAG FUSE FOR PRODUCTION PROGRESS



### Wide Double Contact Surfaces — Spring Tension Locking of Links

WARE HI-LAG Fuses provide extra wide contact surfaces on both sides of links and stronger connections. Link connections are held firm and tight at all times by large arched spring steel washers and heavy studded bolt, which locks the links into the circuit.

Expansion and contraction of metals during *Off* and *On* periods compress links. This fluctuation causes loose contacts and oxidization in other fuses, which finally result in excessive heating and unnecessary blows. WARE HI-LAG construction keeps contacts permanently tight, thus insuring low resistance and longer fuse life.

WARE HI-LAG has many exclusive features in addition to the above; including the Link Design-Double Bridge Knife-Blade Assembly-Gas Vents and Simplified Construction, only 3 Parts. That is why it is known as the World's Best and Coolest Operating Fuse made.

"We manufacture all of our own parts and are making prompt deliveries."

*Write for Brochure giving details of all the  
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#### KNIFE-BLADE

250 VOLTS  
600 VOLTS  
70 to 600 AMPS.



#### FERRULE

250 VOLTS  
600 VOLTS  
3 to 60 AMPS.

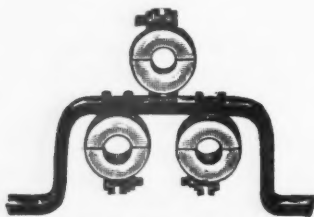
APPROVED BY UNDERWRITERS' LABORATORIES

# WARE Brothers 4450 W. LAKE ST. · CHICAGO 24, ILL.

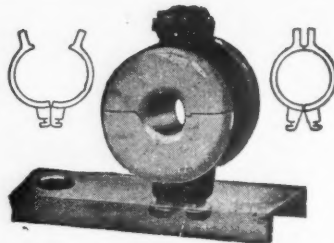


## "EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

### EFFICIENCY NESTED CONDUCTOR RACKS



Nested Conductor Racks available for Cable diameter from 5/16" to 2 3/8".



• Simplicity is keynoted in the design of the EFFICIENCY bushing rack. Note that a single bolt supports the bushing and at the same time clamps the bushing support to the rack. Each fitting is a separate unit . . . permits the installation of each cable independently.

The EFFICIENCY rack is constructed of standard rolled steel channel—sizes according to size of bushings and number of mountings for each rack. Bushing supports are malleable iron. For A.C. service a brass half is furnished. Bushings are glazed porcelain, extra large and heavy.

Complete information on all EFFICIENCY Electrical Devices is available. Write today for your copy of Catalog No. 38A.



## SAVINGS in . . .

Time . Current . Money with

### TRICO Powder-Packed FUSES



Here's a fuse that's DIFFERENT. You get Double Protection plus THREE TIMES THE SERVICE. With TRICO fuses you eliminate unnecessary shut-downs, wasted current and time. Nothing has been spared to make TRICO FUSES outstanding in performance and lasting service.

#### TRICO "Powder-Packed" Renewal Element Offers

- Positive link protection
- Tamper-proof protection
- Positive link support
- Emergency time-lag
- Non-interchangeable link
- Absorbs explosive pressures
- Fire & accident protection
- Guaranteed results

WRITE FOR FREE BOOKLET No. 206-A

### "KLIPOK" CLAMPS

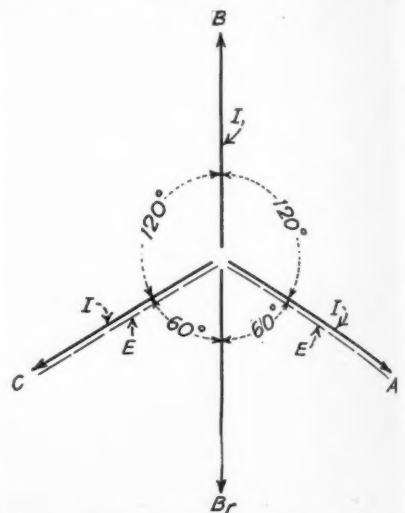
Literally bolt fuses and clips together in a vise-like manner. Reduce resistance—eliminate burnt fuses and clips, lost production, unnecessary shut-downs and wasted current. There's a size for every clip.

Write for Bulletin #6



TRICO FUSE MFG. CO. Milwaukee, Wis.  
In Canada: IRVING SMITH LIMITED, Montreal

phase watt-hour meters acting on the same shaft. Each phase records the product of its amperes and phase-to-neutral voltage times the Cos. of the angle between the current and the voltage of each phase or  $W = IE \cos. \theta$ .



The watt-hour meter automatically compensates for the angle, and the recording is true watts or watt-hours.

To record the wattage in phase B the current in B is reversed so that it is in the position Br. leading phase C by 60 degrees and lagging phase A by 60 degrees. (See Diagram.)

Now if we pass this reversed current through the potential fields of phases A and C it will lead or lag these phases by 60 degrees making Cos.  $\theta$  in the formula equal .5000. Therefore, in each of these elements it will record  $IE \cos. \theta$  or  $IE \times .5$  equals  $\frac{1}{2} IE$ . But the actual watts is  $IE$  so this current is passed through the potential field of both the other phases to record the total watts.

By passing the current of phase B through both the other phases, we get the correct watts of the phase as the resultant of the voltage in phases A and C is in the same phase position and has the same voltage as that of phase B. This compensates for any out of phase which may exist between the current and voltage in phase B due to an induction load.—A.E.T.

### Can you ANSWER these QUESTIONS?

**QUESTION F12**—We have a three ton overhead crane in our impregnating room where we varnish dip field coils. This crane has a rigid box type bridge with a forty foot span, the rails are of T bar suspended from insulators on five foot centers the full length of the bridge. The collector shoes are the sliding type and carry adequate tension with proper shunts, the rails are



## CUT CONDUIT

*with less  
Muscle*



...This efficiency-balanced  
**RIDGID** takes the  
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● Slap this sturdy **RIDGID** Cutter on pipe or conduit and roll it right through in a few easy turns—surprisingly little muscular effort required. You see why the minute you get the efficient feel of its balanced malleable frame—and see the true easy action of its special tool-steel cutting wheel. Every cutter factory tested to insure perfect circle pipe cutting. Your choice of five sizes to 6" capacity; 4-wheel cutters to 4." Buy it at your Supply House.



4-wheel  
**RIDGID** No. 42  
for fast quarter-  
turn cutting in  
tight places.

## PRECISION PIPE THREADS

*Pronto!*

**RIDGID**

No. 65R is ready  
to thread 1" to 2"  
pipe in 10 seconds



65R stands up hand-  
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● Here's the rugged self-contained threader that's a pleasure to work with. No extra dies to carry around or lose. One set does the trick for 1", 1½", 1½" and 2" pipe or conduit—sets to size in 10 seconds! Work-holder sets instantly—only one screw to tighten, no bushings. Hardened precision-cut chaser dies insure fast perfect threads on iron, steel, brass or copper pipe, or conduit. Every 65R factory tested. Ask your Supply House.

**RIDGID**

**WORK-SAVER PIPE TOOLS**

THE RIDGE TOOL COMPANY • ELYRIA, OHIO



# Silicone News



## For Maximum Safety

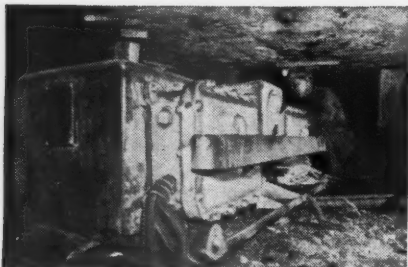


PHOTO COURTESY WESTINGHOUSE ELECTRIC

Silicones help to make this new Westinghouse AC mine power center transformer the safest transformer ever built for mine usage.

Maximum safety and minimum height are combined in this new dry type power center transformer designed by Westinghouse for underground mine service. Only 25½ inches high and weighing only about half as much as a comparable liquid-filled transformer, it can be moved along to almost any point where a miner can work.

Built with such heat resistant materials as silicone bonded glass covered copper conductors and silicone treated coils, this new transformer is hermetically sealed in a nitrogen filled case. It is an excellent example of what creative engineering can do with new insulating materials.

Designers of dry type transformers have for years been handicapped by the limited heat resistance of conventional insulating resins and varnishes. The larger, heavier, and inherently more hazardous liquid-filled transformers have, for that reason, gained acceptance in spite of the maintenance cost of frequent inspection, filtering and reconditioning of the liquid.

We introduced Silicone Insulation to electrical engineers four years ago. We went on to prove by severe testing and actual service records that this new class of electrical insulation will withstand continuous operating temperatures as much as 100°C. above Class "B" limits. This makes it possible to design dry type transformers and other electrical equipment weighing only about half as much and occupying much less space than similar equipment with conventional insulation.

We'll be glad to send you the evidence contained in technical paper No. K22-1.

**DOW CORNING CORPORATION**  
MIDLAND, MICHIGAN

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as clean as can be maintained but in spite of this condition when power is applied to either trolley or hoist motor we pull an arc at these shoes. As stated already this crane travels over these dip tanks full of varnish and the arcing of collectors has cost us one fire. These tanks have covers on them but in our effort to provide safe working we are still confronted with a human element which can hardly be classed as infallible. We would not desire a repetition of this incident. Therefore, a recommendation of some type of explosion proof installation would be desirable or any other suggestion by which we could eliminate this hazard, would be welcomed and considered.—D.J.S.

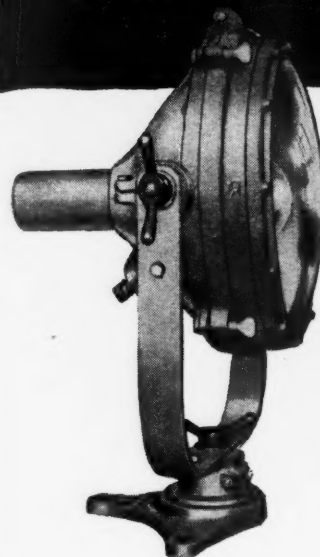
**QUESTION G12**—How can the correct value of capacitor for a single phase, permanent capacitor motor be calculated? Specifically, we were recently called upon to serve a Jennin, ½ hp., 220 volt, 900 rpm. motor. Motor appears to be a regular 2 phase winding, with capacitors in series with one phase. Capacitors were shorted, and had no identification of any nature. This motor manufacturer has gone out of business and his successors could provide no information. Experimenting showed that 10 mfd. would run the motor, but would not provide enough starting torque for dependable operation. 20 mfd. were installed and on a blower are operating satisfactorily. However, starting torque is still so low motor can be prevented from starting by holding the shaft.—W.B.S.

**QUESTION H12**—I would like to know the proper mathematical method to determine the proper size capacitors to use on low power factor loads of fluorescent and neon sign transformers to build up the power factor.—A.C.G.

**QUESTION J12**—In our substation we have 3 rotary converters connected through an equalizing bus to a common d-c bus. These converters are identical six-phase 250 volt machines. They are compound wound 200 kilowatt units. We recently installed a fourth machine in parallel with the original three. This fourth machine is a duplicate of the original three but is of recent manufacture. We find that this new machine will not share the load properly with the other three. If it takes its share of the load at low load, it hogs the load at higher loads. Why does machine do this and what can we do to correct it?—W.P.R.

PLEASE SEND IN  
YOUR ANSWER BY DECEMBER 15

## DEPENDABLE Floodlighting WITH MINIMUM MAINTENANCE



**P**yle-National heavy duty floodlight equipment is built to withstand severe operating conditions; to provide the reliable lighting needed for protection, and for outdoor night work. Pyle-National reflector design and light control lenses assure high efficiency lighting with proper distribution for maximum usefulness. The wide range of types and sizes, from 100 watts to 2000 watts, allows individual requirements to be met easily and economically—substantial weatherproof construction with sealed interior gives maximum protection to reflector and lamp bulbs. Interior cleaning and other maintenance is greatly reduced. Write for Catalog 2100 giving full information, with beam efficiency, candlepower, and light distribution data.

1897 • FIFTIETH ANNIVERSARY • 1947

**THE PYLE-NATIONAL COMPANY**

1344 N. Kostner Avenue, Chicago 51, Illinois







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# Motor Shops



*Samples mounted in storage bins above assembly bench direct mechanic's eyes to proper bin when looking for repair parts. Visual comparison with old part is quicker than scanning bin labels.*

## Sample Parts Provide Quick Identification

Efficiency is the keynote of profitable small motor repair department operation. Lost time and wasted steps must be reduced to an absolute minimum. That is the premise on which the Koontz-Wagner Company, South Bend, Indiana, has organized its fractional horsepower repair department.

Among the numerous small, yet economically significant, ideas incorporated in the shop design, is a visual file of the more commonly used repair parts mounted directly over the assembly bench. The system comprises a series of small storage bins in which parts are placed. Adjacent to the label on each bin identifying the part by function and manufacturer's number, is a sample of the device. Included are such items as rotating and starting switches, collector rings, clip flanges and contact plates.

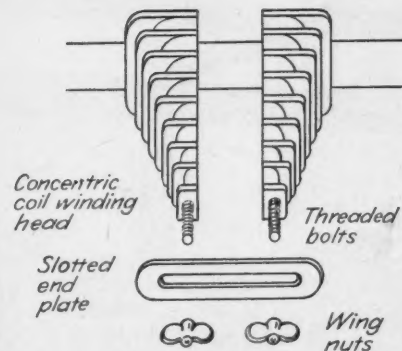
Instead of scanning all bin labels to find a repair part, the mechanic's eye is immediately directed to the sample attached to the bin in question. If visual comparison with the old part is not sufficient, he can then check the data on the label. This, however, is rarely necessary.

Although the time saved per job by

this visual file may seem insignificant, the minutes soon add up to hours and reflect a substantial saving in this business where repair costs frequently run neck-to-neck with selling prices.

## Brace For Coil Winder

Some coil winding heads are made without an outer adjustment and, as coils are wound, the tension gradually pulls the outer limits of the frames together. This results in a finished coil that differs in dimensions from the original and it also creates a certain amount of looseness in the frames and connections. An old concentric-field coil winder in the shop of H. N. Crowder, Allentown, Pennsylvania, was strengthened and is still in use due to an auxiliary brace installed across the outer frames. The brace consists of a steel rod held securely in two collars fitted with wing nuts. A second method for bracing, sketched, consists of a slotted metal plate that fits over threaded bolts and is securely held by wing nuts. After the coil winder has been adjusted for winding, but before coils are actually wound, the outer gap between head frames is



*Concentric coil winding heads are fitted with threaded bolts. A slotted metal brace plate fits over these bolts and is held firmly in place by tightened wing nuts. The brace maintains the gap desired, relieves pressure from the equipment and insures a finished coil of desired dimensions.*

adjusted to equal the gap between heads at the bases. The brace is then tightened in place. This prevents the heads being drawn together, the coils are the desired dimensions when wound and the wear on the winder is maintained at a minimum with little or no strain to the equipment, resulting in increased equipment life.

## Electric Solder Pot

A compact, efficient, electrically heated solder pot is proving to be of valuable aid in the Central Maintenance Electric Shop of the Portland, Oregon, Housing Authority. The pot was entirely constructed of parts available at the time of construction and consists of a short section of conduit, a plugged coupling, thermostat, pilot lamp, resistance wire, asbestos and glass tape.

As reported by T. O. Brintzenhoff, the solder pot is made from a 1-inch rigid conduit coupling with a 1-inch pipe plug screwed into the bottom and sawed flush. A handle was screwed to this pot so that the unit can be easily lifted and carried about the shop as needed for particular jobs.

The heating unit was designed to heat 50/50 solder to 475 degrees F. in a 20-minute interval. The outside of the heating unit is a metal can, 4-inches in diameter and 7-inches in



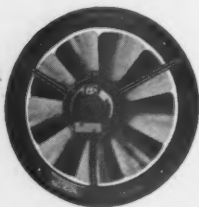
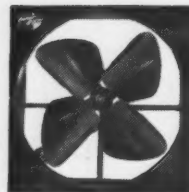


## ...keeps **MEN** in motion

Stagnating production frequently is the result of stagnant air. You'll find daily output of your factory, office or mill benefited when you provide workers with fresh, clean, invigorating air. Moreover, you'll likely find the cost of Emerson-Electric exhaust fans repaid by improved Employee Relations. In the interest of quality production and greater plant harmony, get full information on Emerson-Electric fans at once. Survey your buildings and write direct to us or consult your local Emerson-Electric dealer to suggest the most efficient and economical Emerson-Electric exhaust equipment for your particular air-moving job.

### Move up to 16,700 C. F. M. with **EMERSON-ELECTRIC BELT-DRIVE EXHAUST FANS**

Powered by specially-engineered Emerson-Electric motors, these sturdy fans have an efficient type of blade, rigidly assembled and dynamically balanced to minimize vibration and assure quiet operation. Fan-shaft bearings have lubricating capacity sufficient for 2,000 hours' operation. Made in 48-in., 42-in., and 36-in. sizes.



### An **EMERSON-ELECTRIC FAN** for **EVERY Air-moving Job**

Emerson-Electric Direct-Drive exhaust fans are available in five sizes from 12 to 30-in., in both ball-bearing and sleeve-bearing types. Motors are fully enclosed. Overlapping-blade assembly insures unusually quiet operation.

### Send for **FREE EXHAUST FAN PRODUCTS BULLETIN**

Especially prepared as helpful guide to busy executives interested in plant improvement. Contains full product information, specifications and reference material for plant engineers. Shows typical installations in foundries, machine shops, lofts, show rooms, stores, etc. Send for your copy of catalog No. 476 today.

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MOTORS • FANS • APPLIANCES

height, supported by three legs. The inner receptacle to receive the solder pot is constructed from a short section of 1½-inch conduit, wrapped with a glass tape and wound with No. 22 Nichrome V resistance wire. The space between the inner receptacle and the outer can is packed with asbestos. Rigid support is provided for the inner receptacle by several ties between the sides and bottom of the outer can container. A small oven thermostat maintains the solder at the desired temperature, the thermostat tube being located at the base of the 1½-inch conduit below the solder pot. Leads for the resistance wiring are carried through the side of the can by means of a Federal bushing. Between adjacent legs of the supporting frame are located the thermostat switch, a pilot lamp and a lamp switch. The inclusion of the 6-watt 115-volt pilot lamp furnishes a visible signal to warn shop operators when the unit is in service.

The amount of resistance wire in the unit was determined after several trial windings had been tested. The unit now heats the solder to the desired temperature and holds it at this heat until required for making up motor connections or tinning the ends of stranded wire. The unit is rated at 450 watts and operates on a 115 volt circuit.

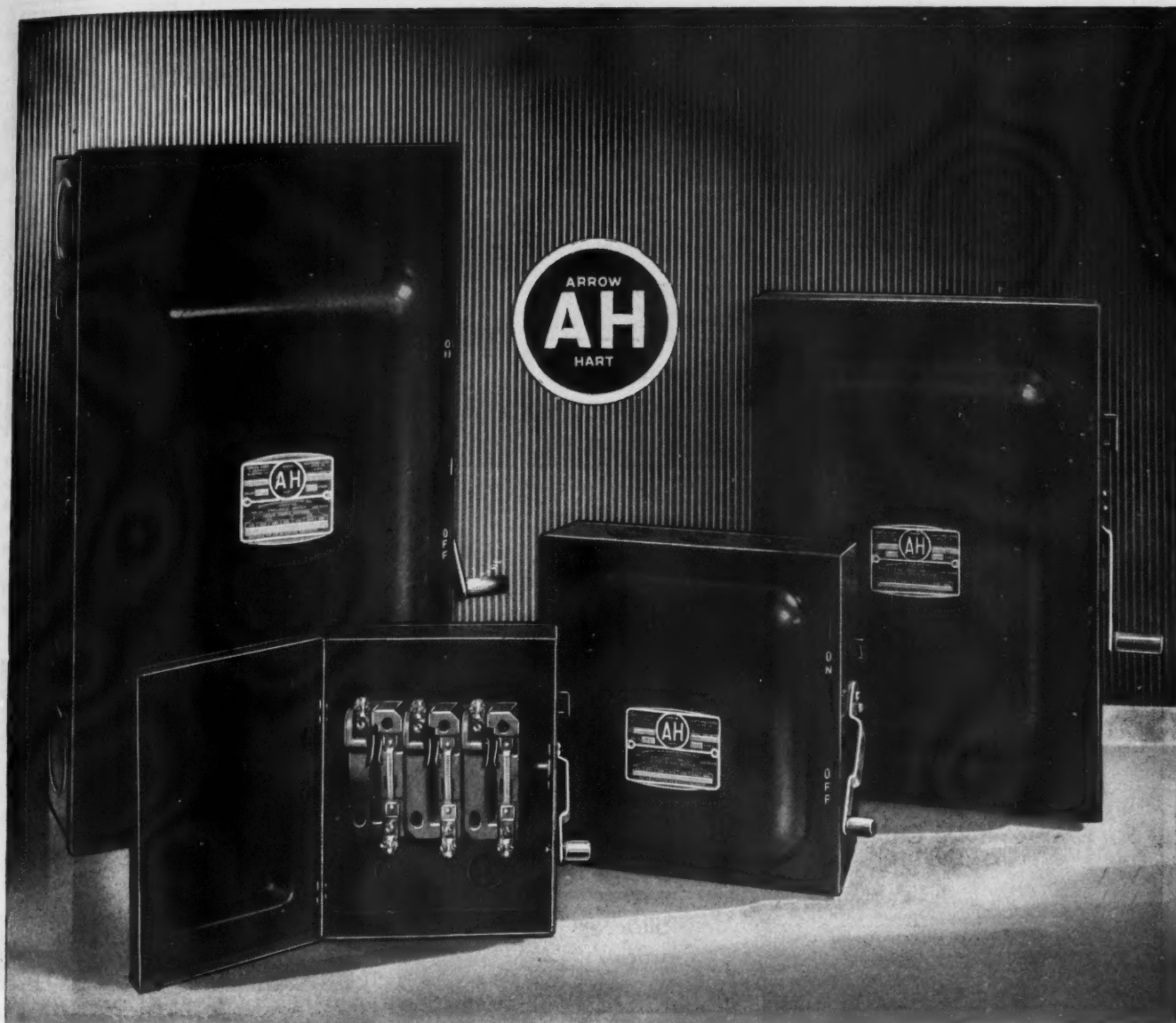
Two of these shop-made units have been in operation for several months. Time has been saved over the soldering irons formerly in use, solder is constantly available, and soldering is replacing other means of making good electrical connections.

## **Oven Made From Ammunition Box**

A salvaged Navy ammunition ready box has been converted into a 10-cubic foot baking oven to aid armature repair work in the Mo-Gen Electric Company's shop in Stamford, Connecticut. The application demonstrates a practical use for one of many surplus products offered for sale by the government.

Two sheets of asbestos board with ½-inch intermediate air space and a sheet-tin skin are bolted to the interior surfaces of the top and sides. Plastic asbestos cement seals the edges. Clamping the lid shut while the asbestos was still wet resulted in a molded gasket that conforms to the contour of the box jamb and confines the heat to the baking area. The air space between the asbestos sheets on the floor of the box was omitted to improve the bearing qualities of the base.





# Enclosed Switches TYPES "A" and "C"

These safety controls of the higher grades serve for a wide range of applications, — reliably in all. Each type embodies the finest materials and workmanship its price-class affords. Both types have quick make-and-break precision mechanism, unit base for each pole 60 Amps. and over. Complete range of knockouts, attractive machine-gray finish. Listed as standard by Underwriters' Laboratories, Inc.

**TYPE "A"** — Range 600 Volts and less; 30 to 1200 Amps. Horsepower rated. Fusible or no-fuse types, with Interlocking Cover (cannot be opened when switch is "ON".)

**TYPE "C"** — Range 600 Volts and less; 30 to 600 Amps. Horsepower rated. Fusible or no-fuse types. Cover non-interlocking with snap latch; may be fastened by padlock. Highly serviceable switch for average requirements; priced lower than TYPE "A".

## Mail this Coupon

To Arrow-Hart & Hegeman Electric Company, Hartford 6, Conn.

Send us your new Catalog C-10 of Enclosed Switches — Types "A", "C" and "D" — and other Service Equipment.

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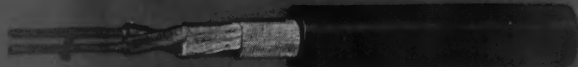
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**THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.**

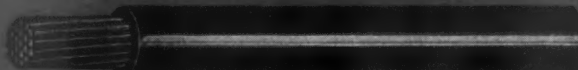


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Makes A Complete Line Of  
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**CRESCORD** . Jacketed Portable Cord



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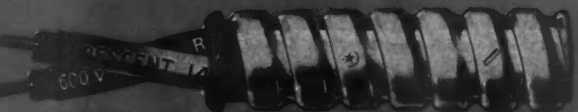
Rubber Covered Building Wire and Cable



Service Cable - Types SE-U; SE-A; SD



**CRESFLEX** Non-Metallic Sheathed Cable



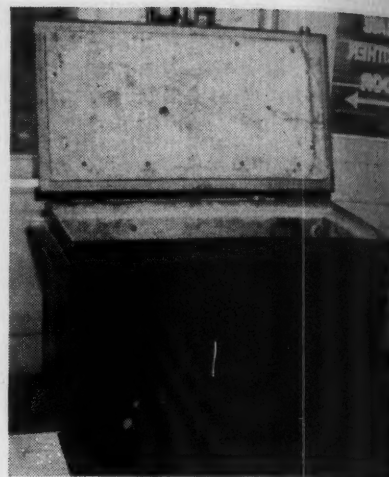
**ABC** Armored Cable

## AND AMONG OTHER TYPES THE FOLLOWING:

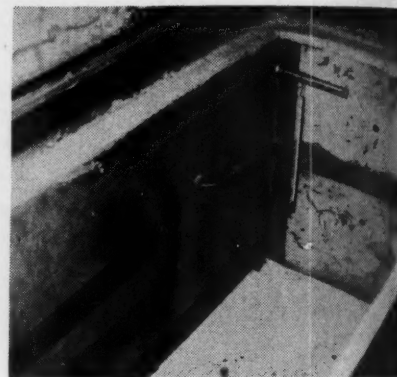
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Brewery Cord  
Control Cables  
Fire Alarm Cable  
Fixture Wires  
Flexible Cords  
Flexible Steel Conduit  
Heater Cord  
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**CRESCENT**  
WIRE AND CABLE  
**CRESCENT INSULATED WIRE & CABLE CO.**  
TRENTON, N. J.



Ammunition box, purchased from Naval surplus products, serves as baking oven in the shop of the Mo-Gen Electric Company, Stamford, Conn. Asbestos sheet lines the box while asbestos cement seals the edges. Adjustable orifice in lower front wall admits regulated amount of air to baking chamber.



Strip heater is bolted to rear wall and temperature is maintained at constant 250 degrees F. by thermostatic control. One-way outward-swinging damper in upper rear wall provides vent and relieves pressures created during baking.

A constant heat of 250 degrees F. is generated by a 2000-watt thermostatically controlled strip heater bolted to the rear wall of the box. A regulated amount of air is admitted through an adjustable orifice in the lower front panel and venting is achieved through an outward-swinging one-way damper in the upper rear wall. Under the drying rack, a shallow tray covers the bottom of the box and catches whatever surplus varnish drips from the baking coils. Since this tray is removable, the box can be cleaned and relined whenever considered necessary. Designed during the postwar period of shortages, this application shows both ingenuity and imagination.

Another useful application for an ammunition box is as a dipping tank. Channel irons raise the box from the floor and provide the necessary space for heating units and drain valves.



# The New P&S 1570

## is a

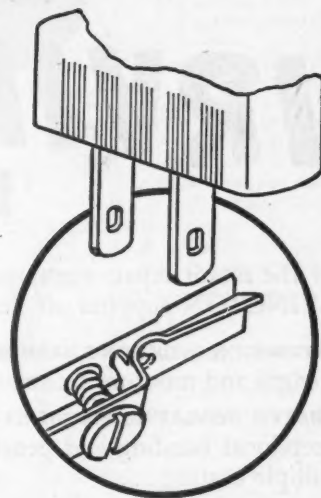
### SPECIFICATION OUTLET

#### FEATURES You Want and GET with P&S 1570

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(hold cap blades securely)
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(two heavy moldings — face and back)
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(for easy alignment with wall surface)
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For the motor repair contractor—or the electrical maintenance shop—IRVINGTON supplies *all* flexible varnished insulation requirements.

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VARNISH & INSULATOR CO.  
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## Portable Racks Hold Job Trays

Most small motor repair departments use the tote box system of metal trays to keep all parts of a disassembled motor together during its trip through the repair line. Adequate storage facilities for these trays frequently presents a harassing problem, particularly when shop space is limited.

The Koontz-Wagner Electric Co., South Bend, Indiana, has sidestepped this problem by using portable racks that fit any shop layout and can be located or moved to best advantage.

Each rack consists of a 6-foot high double A-frame of angle-iron welded to a metal base equipped with six



*Portable storage rack that can be moved anywhere to fit shop layout; holds up to 60 job tote boxes; requires less than 10 sq. ft. of floor space.*

heavy, double casters. The flanges of the A-frame have numerous notches into which fit welded flanges on the backs of 3-sided metal trays (33 in. long, 15-in. wide, 6 in. high). Each side of the frame can accommodate up to seven trays (number depends upon clearance needed between trays).

Each rack tray, in turn, holds either four small, or three large job tote boxes. A platform on top of the A-frame provides additional storage space. A single rack holding about 60 repair jobs requires less than 10 sq. ft. of floor space. Due to handles on trays, and open sides, a single tote box or entire tray can be moved.

Racks can be placed against a wall, or mounted end to end to form a double storage rack partition. They can easily be shifted to conform to revised shop layouts.



# Modern Lighting

## Lighting Promotes Pacific Travel

Outstanding among Los Angeles swank transportation centers is the new ticket office of the Matson Navigation Company. Bidding for tourist attention in the increasingly competitive field of travel, Matson promotes cruises to the southwest Pacific in an atmosphere combining modern illumination and architectural design with primitive native art and tropical plant life. Fluorescent, incandescent and cold cathode lighting are skillfully employed to provide general illumination for interiors of bleached Honduras mahogany while concealed baby spotlights give dramatic emphasis to carved native masks, exotic sculpture and stylized wall charts.

Exterior Matson Lines signs, backlit by letter concealed neon tubing operating at 60 milliamperes, surmount all-glass fronts. Soffit recessed standard Downlights are used for the arcade lighting while similar adjustable units are installed immediately inside window lines for greater display purposes. The area inside the central window is cove lighted by daylight fluorescent lamps.

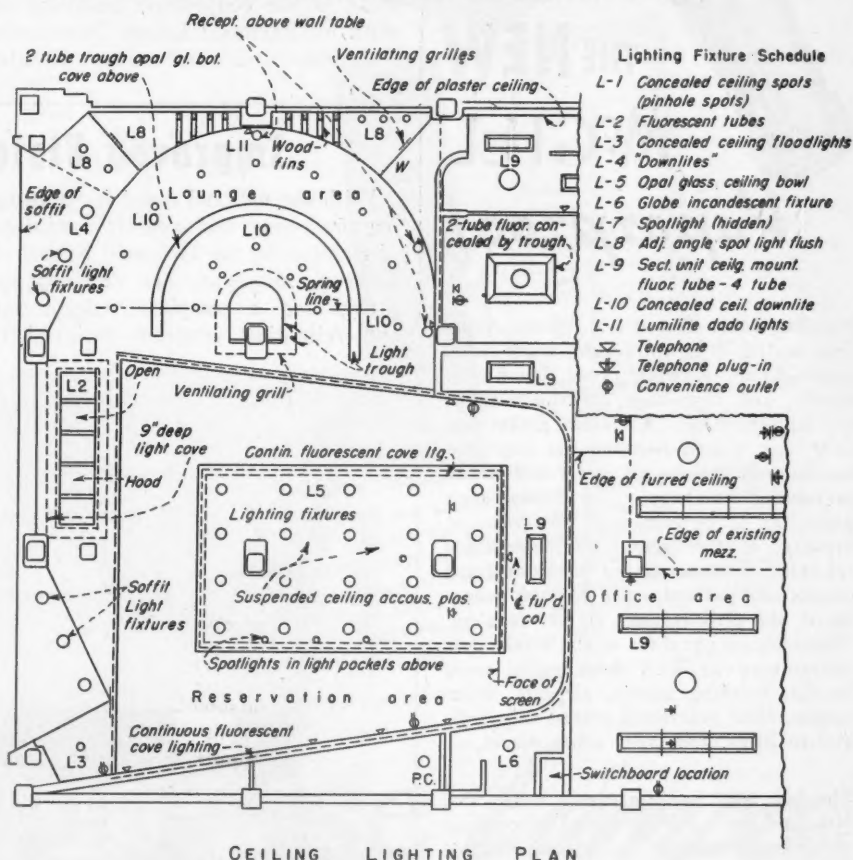
A comfortable, semi-circular tourist lounge, centered around a life sized native statue, is primarily illuminated by a suspended, curved, indirect-direct trough having a lower panel of flashed opal glass and mounting 34 20-watt fluorescent lamps. A smaller light cove, directly above the statue, likewise utilizes 20-watt fluorescents. Pin-hole spotlights and recessed R40 lamps provide additional illumination for this modern furnished area.

Reservations are arranged at a curved flexwood counter located beneath a rectangular suspended canopy containing twenty perforated flat domes of opal glass that conceal recessed 300-watt Downlights. Provision for adjusting the shielded beams gives illuminating flexibility to the uniform fixture pattern. The canopy is cove lighted by fluorescents mounted end to end.

In both lounge and reservation areas, wall decorations and sculpture are accented by lamps in spun metal reflectors and by concealed baby spotlights.



Cruise-minded travelers pass beneath silhouetted signs and through the all-glass entrances to the modernly lighted and decorated interior of the new Matson Lines' Los Angeles transportation office.



Modern lighting is used as an essential architectural component in the dramatic design created by Raymond Loewy Associates for the Matson Navigation Company, Los Angeles, California.

General office space and the freight department, located behind the public area, is lighted by suspended four lamp, 40-watt fluorescent commercial fixtures. Throughout all areas the illumination intensity averages between

50 and 65 footcandles. All lighting, both exterior and interior, is controlled by three time clocks with individual switches on separate circuits to permit manual local operation.

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✱ SHOCK-PROOF  
**SAFE**



No. 3007

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Vaporproof**

Portable Lamp Guard . . . strong, portable, sealed. It is water-tight, vapor-tight, dust-tight and moisture proof. The plastic handle, and fibre cage are shock proof and non-sparking. A rubber gasket has now been placed between the cage and handle, and absorbs all stress and strain, preventing breakage. The heavy glass protecting globe eliminates possibility of breakage of the lamp bulb inside from splashing liquids. Being air-tight these guards are perfectly safe for use where vapor and dust infused air is prevalent. They have no equal for safety, service and convenience around flour mills, paint booths, finishing rooms, airports, warehouses, food processing plants, shipyards, aboard ships, and many other places.

The No. 3007 has the plastic cage. The No. 3006 has a heavily tinned, electrically welded wire cage.

ELECTRICAL DIVISION

**MCGILL**  
**MANUFACTURING CO., INC.**  
**VALPARAISO, INDIANA**



General fluorescent illumination is provided in the lounge by a semi-circular suspended indirect-direct trough and a central ceiling core installation. Pinhole spotlights, recessed flood lamps and adjustable reflector lamps provide additional light.



Perforated, flat opal glass domes shield adjustable 300-watt Downlites recessed into a suspended rectangular coverlighted canopy over the curved reservation desk. Decorative wall charts and masks are highlighted by concealed baby spotlights.

tive atmosphere that provides high level functional lighting in working areas is the cooperative resultant of work by Raymond Loewy Associates, designers and architects; Charles

Stickney, structural engineer; C. L. Hess, general contractor; Claude Seaman, Standard Lighting, Inc., and the Q. R. S. Neon Corporation, lighting specialists.

## Improved Vision In Classrooms

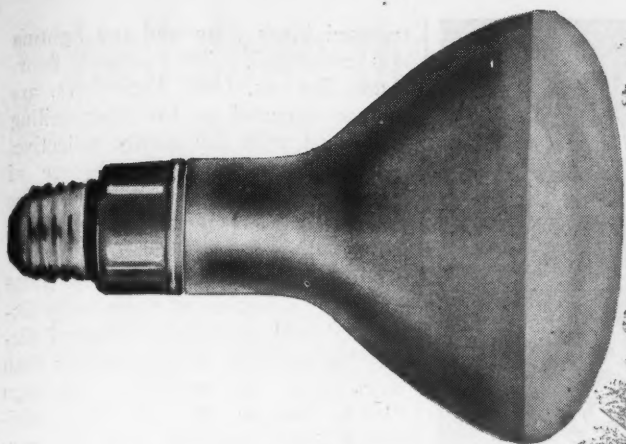
With the national trend for improving the seeing and comfort conditions of classrooms, the Griswold School of Jackson, Michigan, has received approval for a complete redecoration and relighting program designed to

provide standards for modernizing other units in the state's school system. In modernizing the classroom pictured, a complete refinishing was authorized for walls, floor, ceiling and desks. Green Hylophate chalkboards



Classroom in Griswold School of Jackson, Michigan, was completely modernized with new chalkboards, new desks, new lighting fixtures and a repainted interior. Guth Futurlites are now wired for two 4500-degree white 40-watt fluorescent lamps with provisions for additional lamp in each fixture should future lighting requirements so dictate. Average illumination on desk tops is 40 footcandles, with 20 footcandles registered on vertical surfaces of chalkboards.





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**Instruments:** Baking wrinkle finishes  
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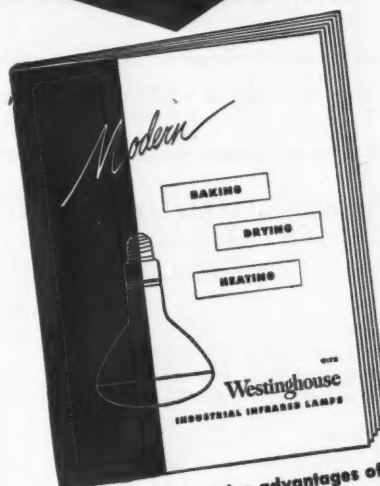
**Metal chairs:** Conveyorized de-  
greasing with infrared lamps saves  
two men's time.

**Signs:** Infrared speed spraying and  
drying, cuts cost 40%.

**Clocks:** Drying lacquer with in-  
frared heat gives 85% saving over  
previous method.

**And in hundreds of other appli-  
cations** Westinghouse infrared heat  
lamps can—and do—cut costs, speed  
production, and make processes easier.

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This new booklet explains advantages of using  
infrared; shows how infrared cuts costs, speeds  
production, and increases flexibility; outlines  
theory of radiant heating; gives check list of ap-  
plications; lists types of lamps; and summarizes  
helpful application data. Lamp Division, West-  
inghouse Electric Corp., Bloomfield, N. J.

# Westinghouse *Lamps*

**Westinghouse Lamp District Offices:**

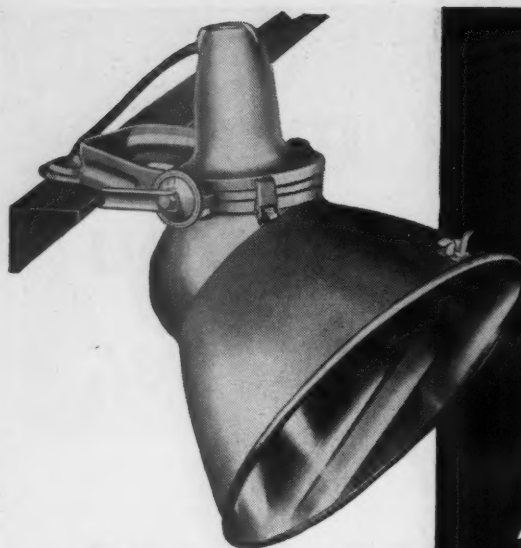
10 High St., BOSTON; 2480 Peachtree Rd.,  
CHAMBLEE, GA.; 20 N. Wacker Drive,  
CHICAGO; 40 Wall St., NEW YORK; 3001  
Walnut St., PHILADELPHIA; 32 Blvd. of  
Allies, PITTSBURGH; 1 Montgomery St., SAN  
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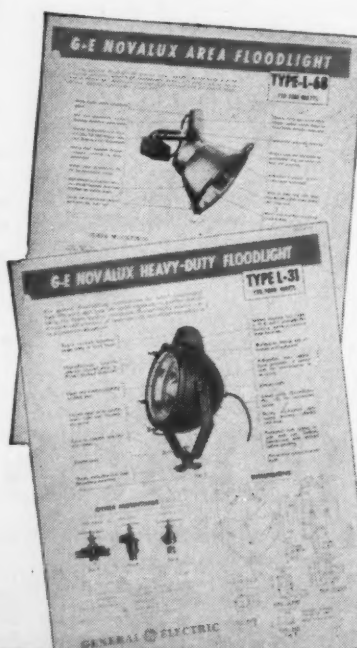
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<b>Heavy-duty, steel casing</b>	
200 or 250 watts, Type L-29	GEA-4303
300 or 500 watts, Type L-30	GEA-4304
750 or 1000 watts, Type L-31	GEA-4305
<b>Heavy-duty, cast aluminum</b>	
1000/1500 watts, Type L-34	GEA-4517
200 or 250 watts, Type L-38	GEA-4325
<b>General purpose, sheet aluminum</b>	
300 or 500 watts, Type L-49	GEA-4311
750 or 1000 watts, Type L-43	GEA-4310
<b>Sports and area, sheet aluminum</b>	
750 to 1500 watts, Type L-68	GEA-4333
750 to 1500 watts, Type L-69	GEA-4590
<b>Area, open porcelain enamel</b>	
300 to 1500 watts Type L-45	GEA-4433
300 to 1500 watts Type L-46	GEA-4434
<b>Handy, sheet aluminum</b>	
100/150 watts, Type L-65	GEA-4516
200 watts, Type L-66	GEA-4346
<b>Underwater, cast bronze</b>	
100/250/400 watts, Type L-33	GEA-4438
500/1000 watts, Type L-39	GEA-4518
500/1000/1500 watts, Type L-41	GEA-4439

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replaced black slate and the lighting was revamped. The present fluorescent fixtures, Guth Futurliters, are surface mounted on the 12-ft ceiling and blend with the highly reflective, light ceiling. With the absence of hangers, a clean, spacious atmosphere is created. Lighting units are wired at present for two 40-watt lamps per 4-foot lengths and have the provisions for ready adaption as three-lamp fixtures should future requirements dictate higher levels of illumination than now exist. In providing for even illumination on all desks, the additional light from the sky was considered, and the pattern of fixtures was shifted towards the interior wall so that outside rows are now 3-feet from the interior wall and 4½-feet from the window line. Additional fixtures are mounted above the front chalkboards to provide an attention-compelling light peak in this area.

A comparative analysis of the present treatment with the previously-existing conditions shows that fixtures now number 21 units, each containing two 4500-degree white lamps. Considering ballasts, the total consumption for the room is 2100-watts which, for the 32½-by-22½ foot area, results in a square foot consumption of less than 2.9 watts. The former lighting plan consisted of 200-watt clear PS incandescent lamps in opal glass bowls.

Ceilings are now flat white, 85 percent reflection factor, where they were formerly ivory, 70 percent. Sidewalls were changed from a cream buff, 40 percent, to a light green, 65 percent. Wood trim was altered from varnished oak, 15 percent, to dark green, 35 percent, to match the present dado. Radiators were formerly dark brown, 25 percent, and are now aluminum, 45 percent. Window shades were changed from a 60 percent cream to an 80 percent white. Dark varnished oak desks are now pearl grey with natural maple tops satin varnished. Black slate blackboards, 15 percent, are now green composition board, 25 percent. The new treatment emphasizes the trend towards lighting with paint, resulting in both higher reflection factors and increased morale.

Light meter readings indicate that the average desk-top illumination has risen from 7 to 40 footcandles and illumination on the vertical faces of the chalkboards jumped from 3 to 20 footcandles. In this brighter, more cheerful atmosphere, students and instructors report increased alertness, less fatigue, greater absorption of presented material and higher morale. The lighting design was prepared by L. D. Lyon of the Consumer's Power Company in Jackson.

**GENERAL  ELECTRIC**



# Nail down these three important facts about

## *Certified Ballasts:*

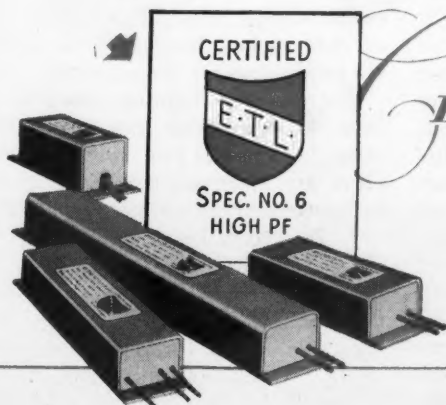
★ They are tested, checked and Certified by Electrical Testing Laboratories, Inc. as meeting rigid manufacturing specifications

★ Leading fluorescent lamp makers will guarantee lamp performance when Certified Ballasts are specified in a fixture

★ They assure dependable operation of a Fluorescent lighting fixture

The word "CERTIFIED" on a fluorescent lamp ballast tells you instantly that here is a product that gives you the greatest possible efficiency in operation and performance of fluorescent lighting. Insist on ballasts bearing the ETL shield in the fluorescent lighting equipment you sell. Give your customers the protection they need and want.

CERTIFIED FLEUR-O-LIER MANUFACTURERS, RLM STANDARDS INSTITUTE and CERTIFIED LAMP MAKERS have solved their ballast problems by writing CERTIFIED BALLASTS into their specifications.



### **CERTIFIED BALLAST MANUFACTURERS**

*Makers of Certified Ballasts for Fluorescent Lighting Fixtures*

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Advance Transformer Company  
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General Electric Co.  
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1905



300 Series

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## TIME CONTROL SWITCHES

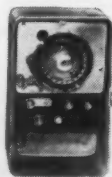
For better construction and easier maintenance of your installations, depend on timers ... Paragon Engineered ... Underwriters Approved ... Telechron Motored. The 300 Series shown above are popular for Stokers, Oil Burners, Pumps, Valves, Window and Sign Lighting.

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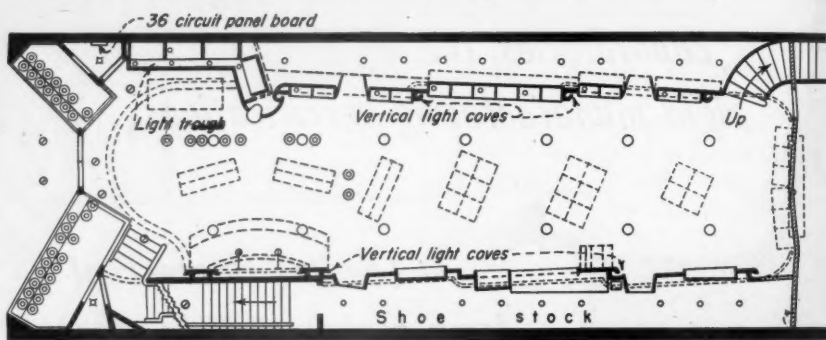
PARAGON ELECTRIC COMPANY

1614 TWELFTH ST.

TWO RIVERS, WISCONSIN



Fluorescent and incandescent lighting are combined to provide a sales stimulating setting in the new Hub Shoe Store.



### Legend

- 300 w. louvered incandescents - Pittsburg No. E-500-8
- ⊙ 150 w. spot Gotham No. 574
- ⊙ 150 w. incandescent - Gotham No. 579
- Stem mounted "streamlite" - Gotham No. 522
- Store fixture light

Sprinkler line and head under duct

### FIRST FLOOR PLAN

Spotlights in show windows and entrance area provide accent lighting to attract customers, while 300 watt louvered and recessed incandescent reflectors provide general lighting for merchandise appraisal. Fluorescent cove lighting adds a decorative treatment throughout.

## Modern Lighting Accents New Shoe Store

One of Baltimore's newest shoe stores has made full use of *planned lighting* for Attraction, Appraisal and Atmosphere—the three A's of store selling. It is the new shoe store of The Hub Department Store, Baltimore.

High intensity incandescent spotlights, using 150 watt R-40 spotlight reflector lamps, are recessed in the ceiling over the main entrance, in show windows, and in the ceiling over center displays just inside the main entrance. These accent displayed merchandise and creates the *Attraction* lighting.

Flush mounted louvered 300 watt incandescent wide spread type reflectors provide a high level of general illumination throughout the store. These provide proper lighting for *Appraisal* of merchandise by customers.

Vertical light coves in the side wall panels, and a horizontal light trough

over the wall panels contain continuous rows of 3500° white fluorescent lamps. These provide a low level of illumination and a pleasing *Atmosphere*.

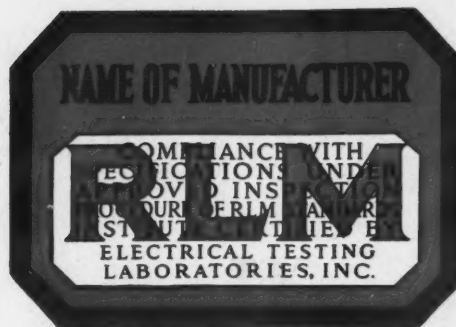
Individual display niches have been built into the side wall panels. These are all individually lighted with fluorescent lamps installed across the top of each niche. Because these niches are small, displays are accented.

The average lighting intensity is over 40 footcandles throughout this store. Intensities on individual displays are much higher, which serves to focus attention on the merchandise.

J. B. Trout, building manager for The Hub, designed the lighting for this store in cooperation with Tyler, Ketcham & Myers, architects, and Egli and Gompf, Inc., consulting engineers. Installation was made by the Blumenthal-Kahn Electric Company.



# Here's the Latest



# Data

## on Industrial Lighting

## for Men who Specify, Buy or Sell

## INDUSTRIAL LIGHTING EQUIPMENT

*New*  
**RLM**  
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14 Different Types  
of Reflectors and  
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307 NORTH MICHIGAN AVENUE

SUITE 420

CHICAGO 1, ILLINOIS



# Questions on the Code

## Ground Connection

**Q.** *Must the grounding connection always be made to the street side of the main water valve?—H.G.*

**A.** Yes, in general, except where the main valve may be buried underground at street or property line or otherwise at a considerable distance from the electric service, in which case the ground may be made to the nearest water pipe (if of sufficient size) provided all unions are bonded around. The above is for service grounding but equipment may be grounded to the nearest water pipe.—F.N.M.S.

## Determining Number Of Conductors

**Q.** *Is it ever necessary to count the neutral or neutrals contained within a conduit when determining the number of conductors permitted by the Code.—L.W.F.*

**A.** Yes, it is necessary whenever the installation is such that the neutral will carry a load. For instance, on a three wire circuit consisting of two phase wires and the neutral the common neutral will carry 1.41 times the load carried by the phase wire supplying the greater load. On the other hand the usual multiwire circuit consisting of two ungrounded conductors with a voltage between them of 230 volts or half that between either one and the neutral, has a load on the neutral equal only to the unbalance of load and therefore may be disregarded in determining the number of conductors permitted within the raceway. Because of this, four multiwire three conductor branch circuits of the single phase type or three multiwire three conductor circuits of

the two phase type may be placed in a common raceway. In either case the ungrounded conductors would be limited in carrying capacity to 70 percent of the carrying capacity for such conductors as shown in Table No. 1.—G.R.

## Conductors for Lighting

**Q.** *I have been given the job of lighting a used car sales lot and plan to run strings of lights from pole to pole about the lot. I had planned to use weatherproof wire, but I have been advised that the Code does not permit this type of wire to be used. Is this true?—L.M.*

**A.** Yes, the Code under Section 7313 pertaining to the insulation used on conductors specifies that conductors used for festoon lighting shall be of the rubber covered or thermoplastic type.—G.R.

## Sealing Fittings

**Q.** *We have been advised that we must provide sealing fittings in each conduit run entering or leaving the refrigerated rooms in a cold storage plant we have just wired. Does the Code contain such a requirement?*

**A.** The Code requires that such conduits be sealed in some manner to prevent the circulation of air from a warm to a cold section of the raceway to prevent condensation of moisture in the cold pipe. This does not necessarily mean that an approved sealing fitting, such as is required in a hazardous location, be used. Section 3015 simply states that the circulation of air within the raceway must be prevented.—G.R.

## Mounting Service Switch

**Q.** *May main switches and meter equipment be mounted directly on cinder or concrete exterior walls?—H.G.*

**A.** The "raintight" type can be mounted directly on masonry walls either inside or outside, if they are properly secured but other types should not be mounted outdoors (unless housed in a raintight enclosure) and in one case should not be mounted directly on such walls.—F.N.M.S.

## Service Entrance

**Q.** *We have a case in our town where it is necessary to run the service entrance through one building to reach another. The building in question is located on a corner and an L-shaped building isolates it from the underground distribution that is run down the alley. We would like to bring service to this building through 60 feet of rigid conduit located in the basement of the L-shaped building and locate the service equipment in the basement of the corner building. Will the Code permit such an installation?—R.P.*

**A.** If the L-shaped building and the corner building are of either common ownership or occupancy this might be done; however, if neither of these conditions exists, Section 2302 will prohibit such an installation unless the conduit within the L-shaped building is covered by two inches or more of masonry. The Code does not require that the existing wall or floor be channeled, it simply states that a conduit or duct under two inches or more of brick or concrete masonry shall be considered outside the building. Therefore, if space is not at a premium,



the conduit run could be placed against the existing wall and then covered with two inches or more of brick masonry or concrete.—G.R.

## Switch Enclosures

**Q.** On a unit heater installation we have mounted small general use switches as disconnects below each unit heater and have mounted the magnetically operated control switch adjacent with a short nipple between the two cabinets. Now we are advised that this is no longer permissible as the general use switch cabinet cannot contain splices. Does the Code forbid such a practice?—K.B.W.

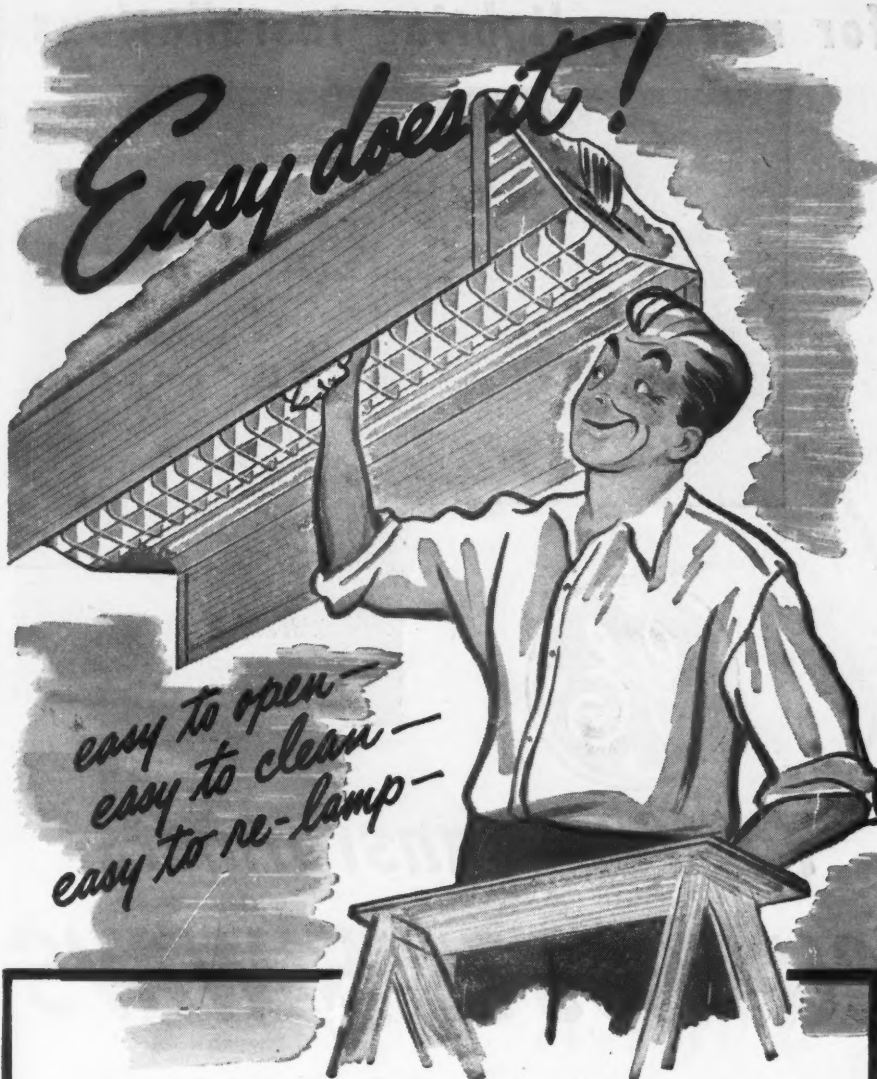
**A.** Many of the small general use switch cabinets do not contain wireways on either side or behind the block. Section 3737-b of the Code has been placed in the 1947 edition to correct this misuse. This section now reads as follows: "Switch enclosures shall not be used as junction boxes, troughs or raceways for conductors feeding through or tapping off to other switches unless special designs are employed to provide adequate space for this purpose."

—F.N.M.S.

## Service Drop Wires

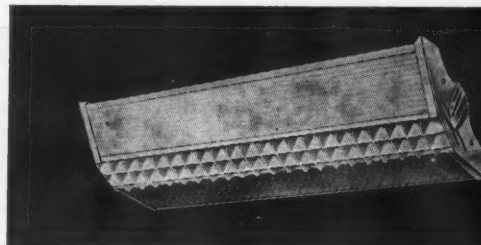
**Q.** I have installed an electric sign on the roof of a building and the utility has run their service drop over the roof of an adjoining building to supply this sign. Now the owner of the adjoining building has requested that I provide additional clearance between these service drop wires and his roof as there is only four feet between them and the ridge of his building. To provide additional clearance, I will have to place a mast or pole of some kind as the structure of the sign is not high enough to provide additional clearance. Does the Code require more than four feet clearance over the roof of a building?—M.H.

**A.** If the roof is flat or the slope is such that the roof may be readily walked upon, Section 2322-a will require 8-foot clearance between the service drop wires and the roof; but if the roof cannot be readily walked upon, the clearance need be only three feet provided the voltage between the conductors does not exceed 300 volts.—G.R.



## The VANGUARD

Newest  
SILV-A-KING  
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Fixture...  
for commercial  
installations



No more dangerous high-ladder gymnastics...no more fancy tools...no more lacerated fingers or strong language! The Vanguard opens as easily, quickly, and safely as your fountain pen—for inspection, cleaning, or re-lamping.

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for mercury lighting installations



## Tulamp Transformers CUT COSTS 5 WAYS

Mercury-vapor lighting, with its high efficiency, is the most economical means of obtaining high levels of illumination in many industrial plants. G-E Tulamp transformers provide the most economical method of installing such lighting.

General Electric high-power-factor Tulamp transformers combine the ballast for two mercury-vapor lamps into one compact unit. Installation and operation costs are cut in these five ways:

**1. TRANSFORMER COSTS ARE LOWER:** A Tulamp transformer costs less than a pair of single-lamp high-power-factor transformers.

**2. POWER COSTS ARE LOWER:** Combining two ballast units into one transformer provides more efficient operation.

**3. WIRING COSTS ARE LOWER:** High-power-factor operation by Tulamp transformers saves copper. Low starting current characteristic permits further reduction in wire size.

**4. INSTALLATION COSTS ARE LOWER:** With Tulamp transformers, only half the number of transformers need be installed—and installation is further simplified by carrying a common ground through to each pair of lamps.

**5. FUSE PROTECTION IS BETTER:** Starting current of Tulamp transformers is less than normal operating current, hence fuses for circuit protection may have ratings down to the operating current values.

Tulamp transformers include units designed especially for the popular H-1 400-watt mercury-vapor lamp. Built by the largest manufacturer of Mercury H lamps, Tulamp transformers assure you co-ordinated design of lamp and transformer. They are quiet, eliminate stroboscopic effect, will give years of dependable operation.

**SHORT DELIVERY** G-E mercury-vapor lamp transformers are available on short delivery. Write for full information on General Electric's complete line of transformers for mercury lighting. Address the nearest G-E office, or Apparatus Department, General Electric Company, Schenectady 5, N. Y.

**GENERAL  ELECTRIC**

## Service Switch

**Q.** I recently installed a  $7\frac{1}{2}$  hp. 220 volt single phase motor and used 100 ampere service switch as both the controller and disconnecting switch. Now I am told that I will have to replace the switch with one rated in horsepower. Doesn't the Code still O.K. the use of a switch having twice the ampere rating?  
—F.C.

**A.** Only for motors of 2 hp. or less. Motors of more than 2 hp. must be controlled by a switch rated in hp. as a controller used on an alternating current motor and must be capable of interrupting the stalled rotor current of the motor. This will be found under Sections 4382 and 4383. You will notice that only 2 hp. or smaller motors may use general use switches rated in amperes when the rating of the switch is 200 percent or more of the full load running current rating of the motor.—G.R.

## Branch Circuits

**Q.** We have wired a number of dwellings which have space in the living room for dining, some are L-shaped and others are rectangular. The inspector insists that all receptacles in the section used for dining be attached to the appliance circuit and we know this will be used 95 percent of the time as a living room as these houses all have dinettes off the kitchen. The houses now occupied are furnished in varying ways. Some, however, have floor and table lamps plugged into the receptacles on the appliance circuit in this dining space. What would you suggest we do about these receptacle outlets?—F.F.

**A.** Section 2115b of the Code states that one or more branch circuits shall be provided for all receptacle outlets (other than outlets for clocks) in the dining room. That is a most definite statement and no one can read any other meaning into it. Therefore it becomes necessary to decide when a dining area is a dining room and that, I believe, is the problem you are confronted with. Most combination living dining rooms have a certain area reserved for dining purposes, and it would seem most logical that a receptacle served by the appliance circuit should be placed in the wall nearest to the possible location of



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the dining table. Inasmuch as other receptacles are likely to be used for floor or table lamps, radios, etc., they should not be supplied by the appliance circuit even though in an L-shaped combination room they might be on the dining area side of an imaginary line. This, of course, is one person's thought, and possibly this question should be sent the Official Interpretation Committee as it is the most commonly asked Code question today.—G.R.

## **Wiring for Leather Tannery**

**Q.** *Following a small electrically caused fire in a leather tannery, I have made a complete inspection of the wiring installation and have found that it consists of ordinary wiring materials which are badly corroded. Does the Code contain specific reference to wiring suitable in this type of factory?*—K.S.

**A.** While Section 1110 does not refer to tanneries, this section contains the ruling you are looking for. "Unless approved for the purpose, no conductors or equipment shall be located in a damp or wet location; where exposed to gases, fumes, vapors, liquids or other agents having a deteriorating effect on the conductors or equipment; nor where exposed to excessive temperatures."—G.R.

## **Conductors in Multiple**

**Q.** *A customer of mine wishes to combine a three phase power service and a three wire lighting service into a four wire three phase common service to take advantage of a new rate schedule. The present power service consists of three No. 500,000 CM in 3-inch conduit and the lighting service is made up of three No. 3/0 in 2-inch conduit. Will the Code permit the three No. 3/0 conductors to be used as the neutral for the three 500,000 CM phase wires if the two service conduits are bonded together at each end or must the old service be replaced?*

—R.W.

**A.** No. Section 3018 states that where an alternating current of more than 50 amperes enters a metal enclosure the conductors of the circuits shall be so arranged as to avoid overheating by induction. If the capacity of a circuit is such that it is imprac-

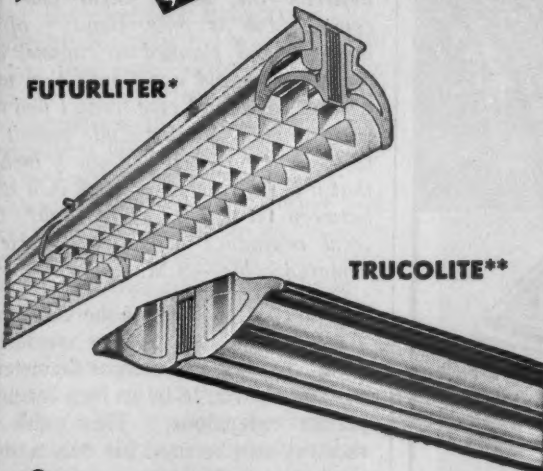




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4. ALZAK will not chip, crack, check, craze, break or peel! It is not affected by dust or dirt.
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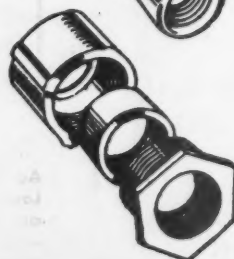
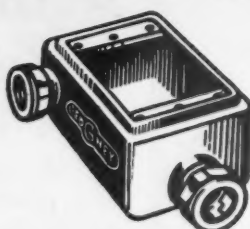
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tical to run all conductors in one enclosure, additional enclosures may be used provided the conductors in any one enclosure (conduit) are balanced in size and include one from each phase used in the circuit in question.

Then under Section 3105 covering the use of conductors in multiple, you will note that all such conductors must be the same size, of the same length, and must even have similar insulation.

—G.R.

## Single Conductor

**Q.** I have been asked to relocate several light outlets in a private office, which necessitates under plaster extensions. This office is completely paneled in wood, and the space between the wood finish and the cement slab is only about  $\frac{1}{2}$  of an inch. I had planned to channel into the concrete and use  $\frac{1}{2}$  inch thin wall, but due to several pipe lines, I find that impossible. Will the Code permit me to use tubing smaller than  $\frac{1}{2}$  inch so that it can be placed in the  $\frac{1}{2}$  inch space between the finish and the slab? Our local ordinance prohibits the use of armored cable.—S.M.

**A.** Section 3442 of the Code gives permission to use conduit or tubing having an internal diameter of not less than  $\frac{5}{16}$  of an inch for under plaster extensions. This small size raceway can be used for only a single conductor making it necessary to run two raceways from the existing outlet to the new location. You will notice the fine print note under this section gives permission to use the single conductor for under plaster extensions inasmuch as the current involved is small and will not cause trouble from induction.—G.R.

## Service Conductors

**Q.** I have just been given a rejection slip because I used solder lugs on a service panel. Is this something new in the Code?—P.H.

**A.** Yes, this is new. Section 2358 of the Code reads as follows: "The service conductors shall be attached to the disconnecting means by pressure connectors, clamps or other approved means, except that connections which depend upon solder shall not be used." The old solder lug terminal has given too much trouble in the past, so its use is now prohibited within service equipment.—G.R.



# In the News

## Farm Electrification Needs Trained Men

Look for a revitalized campaign to acquaint America's farmers with the advantages and production efficiencies that accompany farm electrification. Once more the realization that the farmer must be sold on electrical applications came to the fore at the Second National Farm Electrification Conference in Indianapolis, Oct. 7-8. Biggest bottleneck at present seems to be lack of trained personnel all along the line. That the electrical industry is conscious of this situation was evidenced in the four panel discussions at the two-day session attended by some 300 representatives of the electrical and agricultural fields from approximately 28 states and Canada.

At the equipment distribution and servicing forum, distributors, utilities and manufacturers received their share of brickbats. Biggest gripes: The farm electrical equipment dealer cannot intelligently sell the farmer because he cannot recommend the proper type of equipment or installation. Utilities are not doing a job in telling the farm customer about electric equipment utilization, installation, maintenance and adequate wiring. Some manufacturers are delivering equipment with wrong connections, faulty parts, inadequate service manual information, and maintain short discounts on repair parts.

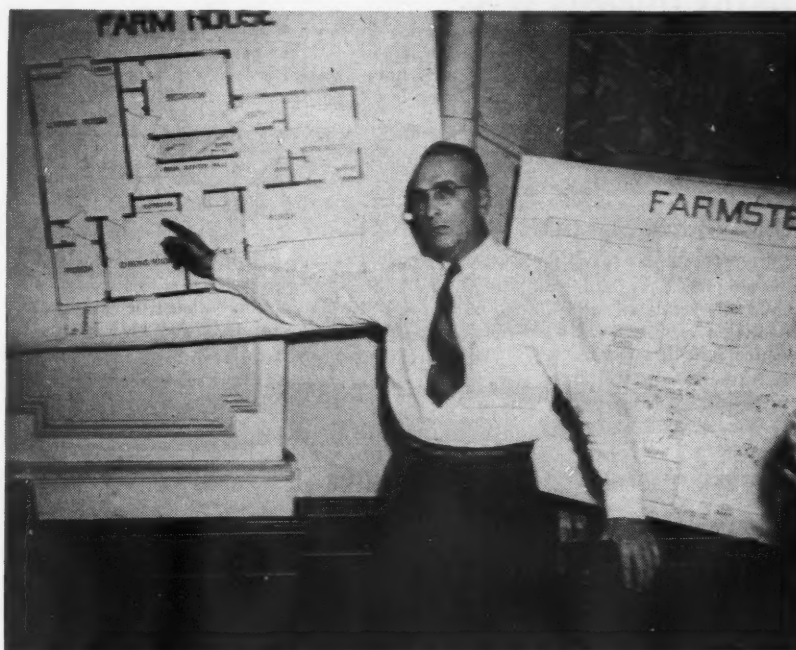
Comments of industry leaders on the panel. C. D. Leiter, F. E. Myers & Bro. Co., Ashland, Ohio: The Myers company has held some 250 classes for some 6000 dealer personnel to teach them how to recommend and sell water systems tailored to the farmers requirements and resources.

N. H. Callard, Westinghouse Electric Corp.: Farm dealers must use application and demonstration selling, use demonstration farms to sell others, take an active interest in customer service. J. A. Mahr, Indianapolis Power & Light Co., thinks utilities must take more interest in farm customers from standpoint of advice on equipment, layout and installation. Present difficulty—only one power man to about 1000 farm customers.

Frank Watts, *Farm Journal*: The power suppliers are not doing the educational job they should be doing. Farmers are buying equipment but are not being sold. Few wholesalers are do-



Officers of the 1948 National Farm Electrification Conference, elected at recent Indianapolis convention, are: (L to R) vice-chairman—C. D. Leiter, F. E. Myers & Bro. Co., Ashland, Ohio; chairman—Frank Watts, *Farm Journal*, New York; secretary-treasurer—Frank Innes, *Electrical World*, New York.



With specially designed board, L. A. Walls, wiring specialist, Monongahela Power Company, Fairmont, W. Va., demonstrates disadvantages and fire hazards of inadequate wiring at recent National Farm Electrification Conference in Indianapolis.

ing anything about the farm market despite the fact that farm electrical equipment potential is 1½ million dollars daily for the next ten years. Frank Innes, *Electrical World*, agreed that utilities must do a better selling job but have not the manpower to do it; also felt that the ultimate responsibility for servicing farm electrical equipment rests with the power supplier because of time and distance considerations encountered in rural work.

E. J. Kendall, Indianapolis farmer asserted that apparatus depending on continuity of electric service should not be recommended or sold unless the utility gives the farmer reasonable assurance of service ahead of non-essential users. Too much is at stake when a milk cooler, chick or pig brooder or pasteurizer is out of service too long.

W. L. Beard, electrical dealer at Newark, Ohio finds equipment coming from manufacturers with wrong con-



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**WIRE & CABLES**

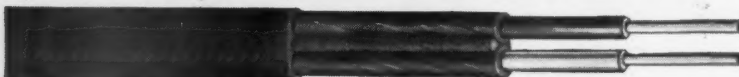


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#### VARNISHED CAMBRIC INSULATED POWER CABLES (Type V)

These cables permit higher safe operating temperatures, up to 85°C.—carry heavier current loads with a given conductor. COLLYER Varnish Cambric insulation is well known for long life and high dielectric strength, resisting oil, ozone and heat. Available braided or lead covered, single or multi-conductor, for voltages up to 15,000.

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nections, faulty parts, inadequate service information; believes dealers should get at least a 50 percent discount on repair parts.

Advertising to rural prospects must be factual in nature and keyed to sell the advantages and benefits of using equipment rather than pure product promotion, asserted D. E. Washburn, United Cooperatives, Inc., Alliance, Ohio. Farmers resent ballyhoo and want factual details.

To better serve rural customers and cut distribution costs, Ralph J. Brown, General Electric Supply Corp., Bridgeport, Conn., suggested that wholesalers maintain a stock of standard equipment and parts near the point of use.

Speaking as an REA man in Iowa, P. T. Rhodes believes that the distributor must train the dealer so he can in turn educate the farm customer. Farmers should know the bad points as well as the good ones about various equipment; should know that electricity can be hazardous, hence equipment and wiring must be installed by a qualified electrician. Power suppliers should have electrical advisers who are also qualified wiring inspectors.

Too much of this load is placed on the dealer who can't handle it on a 25 percent margin, asserted Dawson Womeldorf, Public Service Company of Northern Illinois. To demonstrate equipment, his company is putting drinking cups and thermostatically controlled electric heaters in numerous poultry houses this coming year.

#### Farm Wiring

The farm wiring panel revealed that considerable attention is being directed to wiring farms newly connected to the lines, but little is being done to promote rewiring of existing farmsteads that have long ago become inadequate.

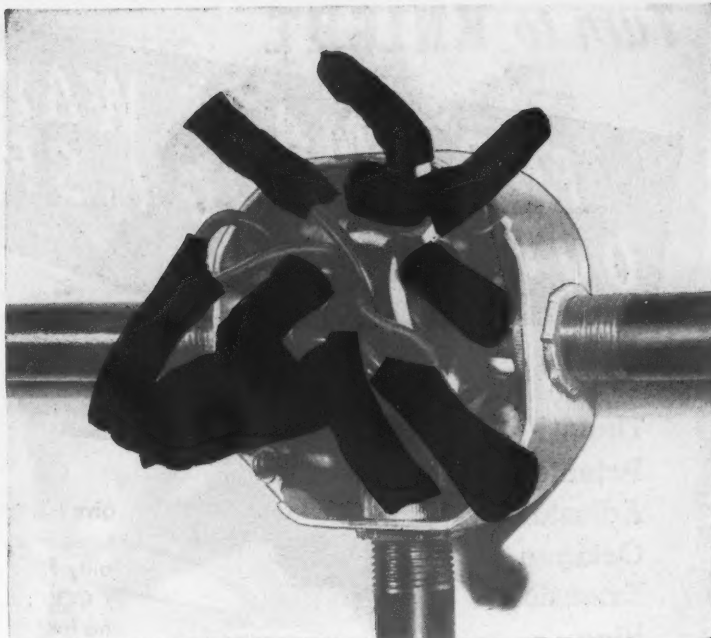
The effects of inadequate copper capacity was dramatically demonstrated by L. A. Walls, wiring specialist, Monongahela Power Co., Fairmount, W. Va. With a specially designed board he showed the reduction in light output when circuits were overloaded; the fire hazards attending insertion of pennies behind blown fuses.

An example of an outstandingly progressive farm wiring promotion program was presented by George C. Merkel, United Light and Railways Service Co., Davenport, Iowa. His company prepared a booklet explaining electrical terms, wire sizes, circuit types and planned wiring for typical farm buildings. Each farm wiring representative follows this procedure: Contacts farmer to sell wiring; prepares the wiring plan which is reviewed by a company supervisor; presents plan to farmer then contacts contractor with farmer; checks installa-



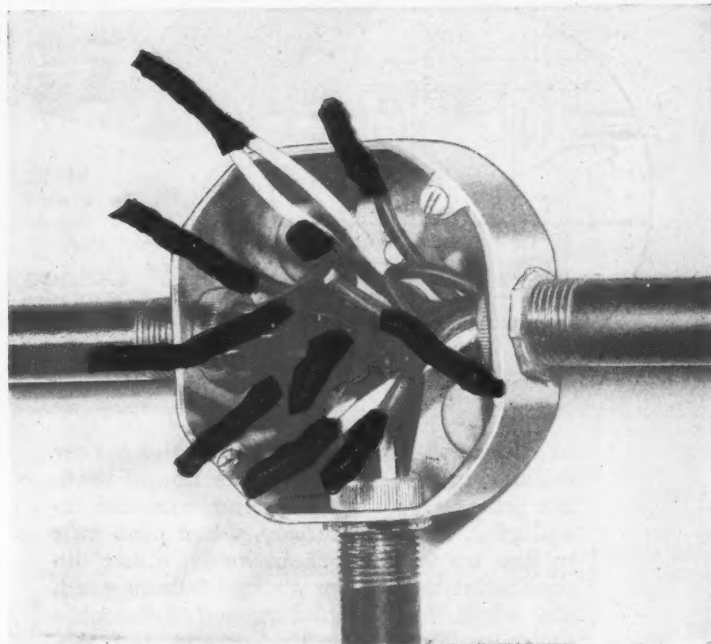
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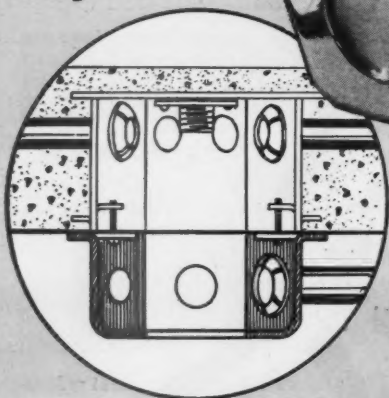
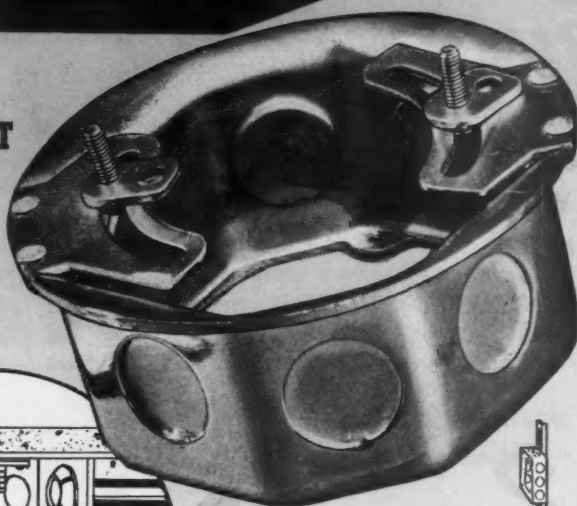
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New fruit-jar dust and vaporproof haymow lighting fixture is being examined at recent National Farm Electrification Conference in Indianapolis by: (L to R) Karl Gorham, Electricity on the Farm; E. J. Gildehaus, rural service manager, Union Electric Co., St. Louis; Ted Perry, electrical inspector for Marion County, Indiana; and Fred P. Oliver representing Union Insulating Co., Inc., Parkersburg, W. Va., manufacturers of the unit.

tion when completed. Concentration is on new wiring; rewiring being done only on request of the farmer, he revealed.

Discussing the role of educators in farm wiring, Harold H. Beaty, Iowa State College, asserted that the root of all wiring difficulties is lack of knowledge. He suggested farm wiring education programs at farm group meetings, film and slide presentations and training programs for county and other agricultural workers. Help for the contractor and dealer—the key to the wiring problem—must be maintained. It's a teamwork proposition, he added, stating that primary educational work must be done before the farmer gets electric service. After he's connected, the farmer invariably loses interest in his wiring job.

Biggest headache for the electrical contractor doing farm wiring is the prevailing difference between urban and farm wiring standards and the difference between various REA Coop standards, revealed John W. Van Ness, Van Ness Electric Company, Valparaiso, Indiana. Coupled with that is the tremendous inventory of multiplicity of types of wire and equipment the contractor must carry. A better competitive picture will result if the utilities and REA Coops get together a common set of regulations and standardize on wiring methods, he believes.

Urban contractors who do farm wiring do not understand farmers' needs, do not plan wiring for future primarily because of price, stated W. A. Corkran, Alabama Power Company, Birmingham. Conversely, rural contractors



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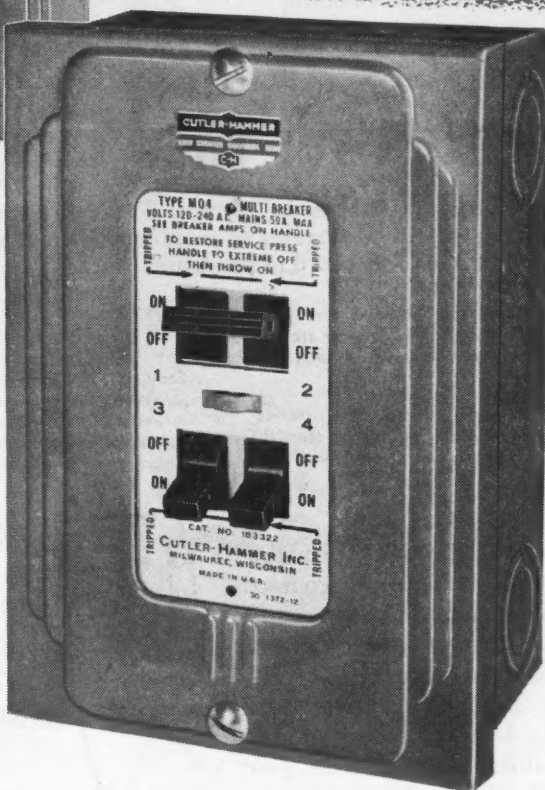
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4 poles

Thermal-Magnetic trip

Easy to install

and wire.



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This new small size Multi-Breaker measures only 5" x 7", yet has 4 poles, with circuit ratings of 15, 20, 30 amperes, and has thermal and magnetic trip heretofore found in industrial type Multi-Breakers. The magnetic trip operates instantly on short circuits. The thermal trip holds on harmless overloads.

The two top or two bottom poles can easily be connected for double pole circuits by using the tie bars provided.

The Cutler-Hammer MO 4 Multi-Breaker is available for flush or surface mounting. It is engineered and manufactured throughout to world famous Cutler-Hammer standards making it unusually rugged and dependable.

There is a wide market for the Cutler-Hammer

MO 4 Multi-Breaker in new housing of every type, stores, homes, offices, factories, schools and shops. In some cases the MO 4 can be used as a service entrance switch, in other cases as load center protection. Feature and show the Cutler-Hammer MO 4 Multi-Breaker at every opportunity. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

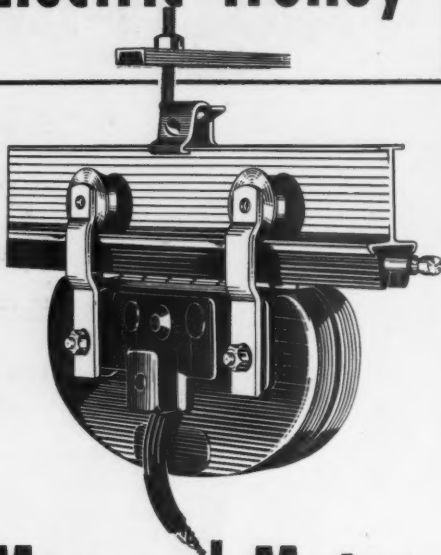




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## Protection for Men and Motors

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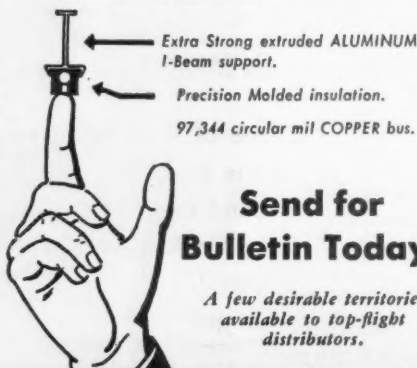
**Eliminates Single-Phasing** of motors due to positive multi-shoe contact. Motors are protected from overheating, burn-outs, and starting failures.

**Non-Arcing** because of multi-shoe compression contact of five shoes, rather than the rolling or sliding action of out-moded trolley wheels.

Conforms to requirements of all state, national electrical and safety codes.

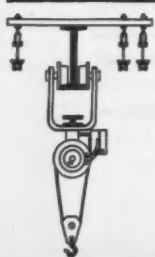
**Easy to Install and Maintain.** Highly flexible positioning of mounting brackets which means low-cost, fast installations. Rigid 10-ft. I-beam sections adaptable to all curves, switches and interlocks.

The recesses through which the five shoes simultaneously contact the conductor are of such shape and size as to make even intentional contact with the line conductor difficult! Because of such remarkable safety, the system can be installed close to galleries, catwalks, ladders and elevated storage areas.



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The rural wiring market is the pre-session topic of John R. Netedu, advertising manager, Penn Electric Switch Co., Goshen, Indiana; and Russell J. Gingles, manager, NEMA Farm Electrification Bureau, at recent NFEC meeting in Indianapolis.

know farming but need training and experience in his area. As a result of his company's efforts to train rural contractors, wiring installations have been improved, he reported.

Down in Crewe, Virginia, the Southside Electric Cooperative used its own wiring groups to wire homes along its lines, stated R. B. Hicks. Contractors at first resented the Coop doing 91 percent of the homes along the lines at one-half the prevailing price per outlet; later joined in the activity as sub-contractors, he revealed.

Rewiring is an important activity of the Boone County REMC, Lebanon, Indiana, according to H. E. Antle, manager. Since adequacy of the wiring system varies with the addition of productive equipment, power suppliers must be ever conscious of wiring system obsolescence, he cautioned.

### Farm Electrical Needs

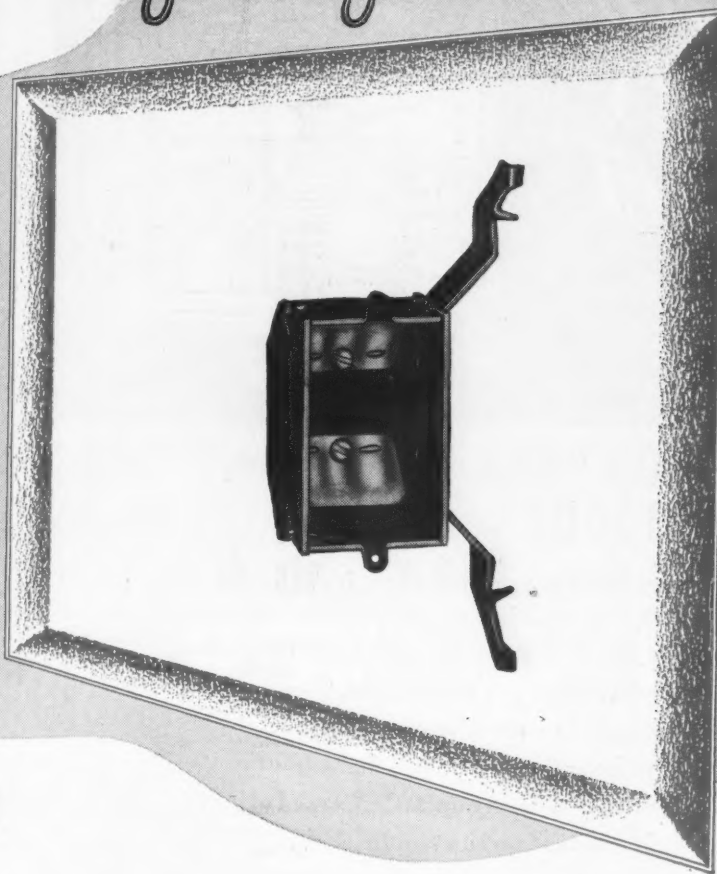
Two panel sessions covered farm electrical equipment needs and educational and in-service training. There is a need to consider the farm as a factory, stated S. T. Henry, McGraw-Hill Publishing Co., Inc. Basic reasoning: Some 1,250,000 farms produce 80 percent of the food with the remaining 20 percent being produced by 4,250,000 farms. Farms are potential consumers of a lot of current, he added. His own farm near Ashville, N. C., can use 6,800 kw-hrs. annually (including barn load). More large motors are needed to release the tractor to field chores.

H. J. Gallagher, Consumers Power Company, Jackson, Michigan, asserted that the utility's view of the farm is changing, as the farm business is changing. If there is a power demand,

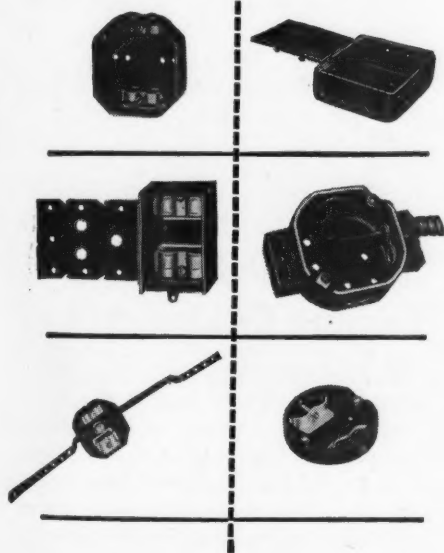


*You can always rely on Raco*

**BLNO**—a new bracket on a nationally popular **STEEL** box—especially suited for non-metallic sheathed cable. Speeds up residential jobs—nails directly to studding. Not necessary to notch studs on rock lathe jobs. Long nailing prongs gauge and hold box in correct position until nails are driven. Knock-outs are "Pri-Out" equipped.



#### A BOX FOR EVERY NEED



Raco products are listed by Underwriters Laboratories, Inc.

**RACO**  
ALL-STEEL PRODUCTS

### **RACO Switch and Outlet Boxes**

Profit by the line of least sales resistance! It's no secret that designers, architects and electrical contractors—the country over—prefer and demand the RACO line. There's a box and cover, accurately made and machined, tailored to fit the particular needs of every type of installation. Sturdy RACO boxes in their smooth, lasting black or galvanized finish, are built to do the job right!

★ ★ ★

#### **A-S-E STEEL PRODUCTS FOR MANY USES**

STEEL OFFICE FURNITURE • WARDROBE, STORAGE, AND COMBINATION CABINETS • CLOTHING LOCKERS • INDUSTRIAL EQUIPMENT FOR FASTER MATERIALS HANDLING • FROZ-N-FOOD LOCKERS • ELECTRICAL OUTLET AND SWITCH BOXES.

ALL-STEEL EQUIPMENT INC., 600 Kensington Avenue, Aurora, Illinois

**A Complete Line of Switch and Outlet Boxes**

**ALL-STEEL EQUIPMENT INC.**



*Installed  
wherever  
Profits  
Count*

plenty of jobs in every  
shop or plant  
for



## R & S EXPLOSION-PROOF FIXTURES AND FITTINGS FOR ALL OUTDOOR AND HAZARDOUS AREAS

There are satisfactory profits when installing R & S Electrical Fittings and Fixtures for those hazardous and outdoor jobs. Profits on the many units and wiring

installations . . . and profits, likewise, in customer good will. And you keep the profits you make because R & S products withstand the toughest service conditions . . . whether meeting the abuse of extreme climatic conditions, vapors, dust, or explosive gases. Once installed there is no costly troubleshooting. The reason why: R & S Fixtures and Fittings are precision-built, sturdily constructed, and undergo severe tests to assure enduring and dependable performance.

The well-known R & S EVER-LOK wiring devices prevent accidental interruption of service for the life of the job. All units afford a high degree of interchangeability.

A descriptive and illustrated catalog gives pertinent information. Address Dep't 4.

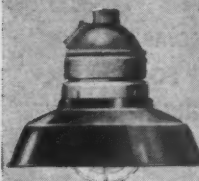
SALES OFFICES  
IN PRINCIPAL CITIES 60



4201 BC



4462



4507



4201 BCC



4411



4521



**RUSSELL & STOLL COMPANY, INC.**

Precision-Built Electrical Equipment

125 BARCLAY STREET, NEW YORK 7, N. Y.

the utilities will deliver it—but the farmer will have to pay for it.

J. P. Schaefer, REA technical standards division, Washington, D. C., sees a need for agreement among manufacturers on specifications, definitions and testing and rating procedure. Farmers need ready-assembled units, rather than have to buy separate parts from various manufacturers and assemble them himself. Far more research on all phases of farm electrification is necessary, stated B. C. Reynolds, USDA agricultural engineer. Application of super-sonics, electronics and radio activity may revolutionize future farm electrification, he added, stating that the USDA plans to spend \$20 to \$30 millions to study application of electrical energy to agriculture.

P. T. Montfort, Texas A. and M. College described four fields that are in urgent need of trained electrical personnel: (1) Use of electricity in farming operations; (2) type and size of equipment suited to each farm or operation; (3) efficient operation of electrical equipment on the farm; and (4) adequate maintenance and service of farm electrical equipment. Manufacturers, dealers, agricultural agencies and press are involved in such a training program, he added. There was a general panel agreement on this point.

New officers for the 1948 National Farm Electrification Conference are: chairman—Frank Watts, executive assistant, *The Farm Journal*, New York City; vice-chairman—C. D. Leiter, F. E. Myers & Bro. Co., Ashland, Ohio; secretary-treasurer—Frank Innes, associate editor, *Electrical World*, New York City. The next conference will be held in Chicago during the latter part of next year.

## Sales Need Sparks League Conference

Taking as its conference theme "Everything Has To Be Sold!", the International Association of Electrical Leagues held its twelfth annual meeting Oct. 8-11 at St. Louis' Hotel Statler. To many, this slogan may appear somewhat premature in the light of present conditions. To approximately 60 electrical league managers and guests at the conference it was a ringing challenge that has to be met now; a challenge designed to jostle the industry out of its wartime complacency.

Using the conference theme as his keynote subject, president W. G. Hills, Washington, D. C., outlined his philosophy of free enterprise. Only through production can poverty be abolished, living standards raised and



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# LIGHT *for* SEEING *and* SELLING



"A Permaflexor Portrait"

THE THREE SISTERS  
St. Paul, Minnesota  
Architect: I. M. Cohn

PITTSBURGH PERMAFLECTOR Fluorescent and Incandescent Equipment represents a great advance in the science of planned lighting.

Designed and engineered to meet the requirements of all types of installations—commercial, industrial, institutional—this "ready-made" equipment gives "custom-made" illuminating results.

A call to our representatives or home offices will bring details on how you too can get more efficient illumination for every application by the use of Pittsburgh Permaflexor Lighting Equipment.



## PITTSBURGH REFLECTOR COMPANY

OLIVER BUILDING • PITTSBURGH 22, PENNSYLVANIA

Lighting Engineers in All Principal Cities

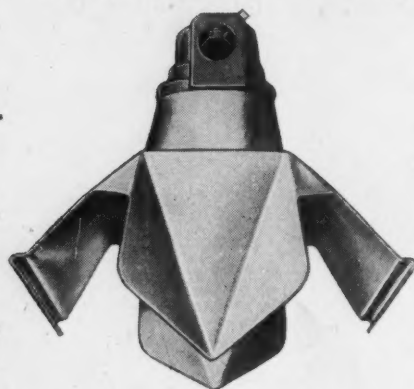
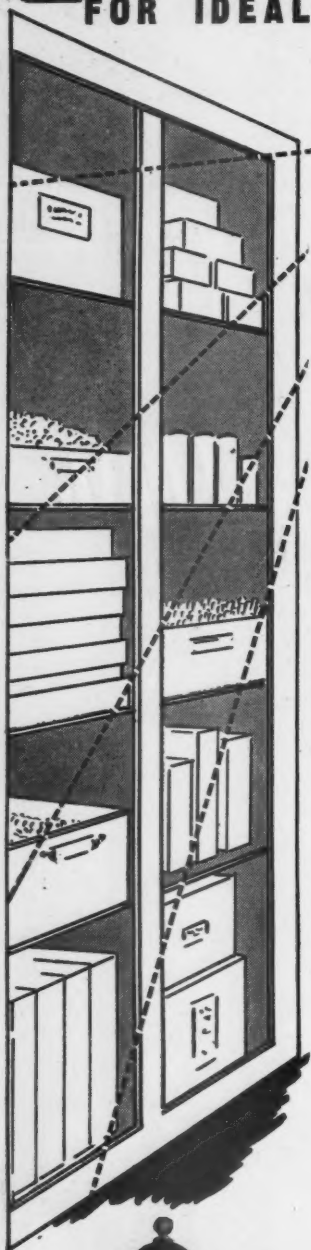
PITTSBURGH PERMAFLECTORS ARE DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE



# QUAD

## AISLE STOCK REFLECTORS

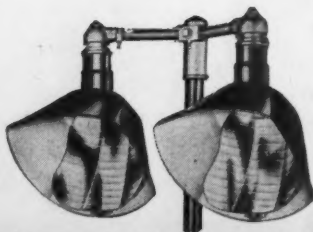
FOR IDEAL SHELVING ILLUMINATION



● This type of reflector fully meets the need of illuminating shelving, bins, or stacks of cartons piled on either side of narrow aisles. It does this important job because of its unique and practical design. Scientifically arranged reflecting surfaces make it possible for light to reach from upper tiers of shelving to floor level. There is effective eye shielding too. It is accomplished because of a lower light cut-off angle at each end of the reflector.

Suggest this reflector wherever you have a stock room lighting installation. Get all the details from us now!

SOLD THRU ELECTRICAL WHOLESALERS



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325. PEORIA ST.

CHICAGO 7, ILL.



*New president of the International Association of Electrical Leagues, S. E. Strunk, Cleveland, receives the gavel and well wishes of retiring president W. G. Hills, Washington, D. C., at recent St. Louis conference.*

wealth created, he asserted. Only through selling can the demand for production be created. Long ago we learned the technique of mass production and creation of mass markets. Only recently have we learned that Everything has to be sold—our goods, our practical ideas, our worthy causes, our very way of life. Our electrical industry owes its growth to competition and effective selling. We must maintain strong League organizations and promotional activities, he concluded.

Our present day economy is cracking under the impact of our war years, warned Merrill E. Skinner, Union Electric Co., St. Louis. We have inadequate production in the face of record production. We have epidemic demands for more pay for less work. Thinking people are beginning to question our business operations, high prices and receding living standards. It's high time that we begin to take a microscopic look at ourselves, he warned. To again sell the electrical industry to the public we must: (1) Shed our complacency and become concerned about our business and customers; (2) rekindle our old sales religion with a fresh start and some new ideas; (3) provide sales training leadership and organization through our Leagues; (4) sell the "Do It Electrically" slogan; (5) look for capable personnel in our own ranks for promotional work. Unless we shake our present complacency and smugness, we are riding for immediate fall. We need a more objective attitude toward our business, he concluded.

Jobs are not made in the factory but on the sales floor, stated C. G. Pyle, managing director, NEWA, while discussing the Oneness of the electrical industry. When a sale is lost everyone

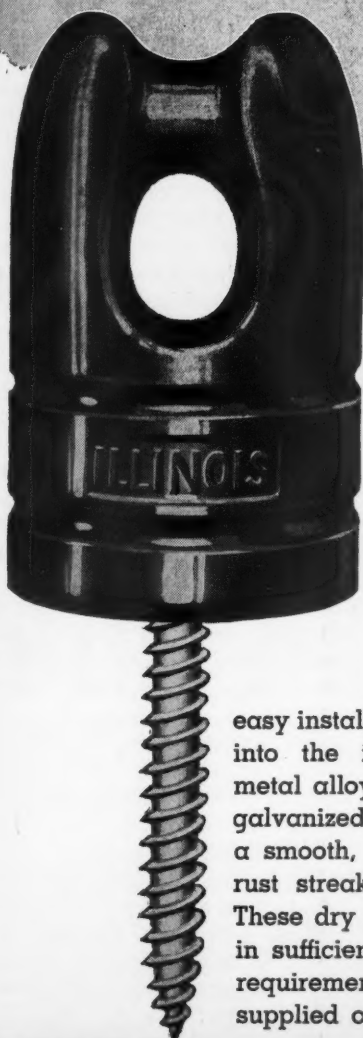


*Free from Internal Stress*

# ILLINOIS GUY STRAIN INSULATORS

• Only materials that meet our high quality specifications are used so that we can assure top quality guy strain insulators. Plant control guarantees the proper handling of the material—careful firing makes possible an insulator without internal stress.

**HIGH MECHANICAL STRENGTH  
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**MAKE SAFE HOUSE  
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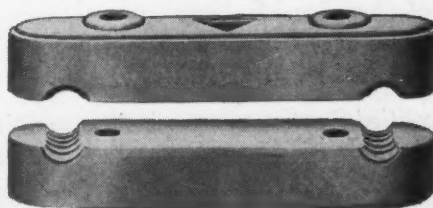
## ILLINOIS PORCELAIN WIREHOLDER INSULATORS

• All corners are rounded to prevent injury to the insulation of the wires. The screws have deep, sharp threads for easy installation. The screws are fastened into the insulators with non-shrinking metal alloy. The all-steel screws are hot galvanized by a special process to insure a smooth, even coating. Will not cause rust streaks on the sides of buildings. These dry process wireholders are made in sufficient styles and sizes to meet all requirements. Wet process porcelain supplied on special order.



**KNOB**—Cement coated—extra length nail—genuine leather washer—code standard. They don't chip when driven in and they do stay in place and have a firm grip. Available in a wide variety of heights, diameters, holes, and grooves.

**STANDARD TUBES**—In sizes 1/2 to 48 inches long. 5/16 to 3 inches diameter in following types: unglazed, glazed, split, headless, curved end, and crossover. Diameter all uniform both inside and outside.



**STANDARD CLEATS**  
of all sizes and types available

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# ELECTRIC POWER

## for any purpose

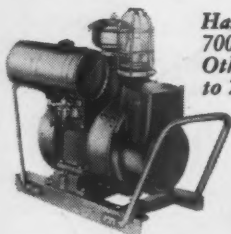
with a . . .

### Universal

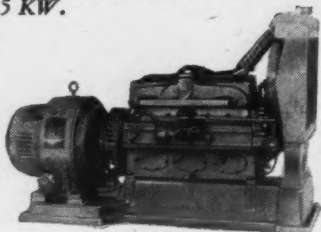
"MATCHED UNIT"

## ELECTRIC PLANT

PORTABLE • STAND-BY • STATIONARY MODELS



Hand portable models  
700 to 1200 watts.  
Others from 250 watts  
to 25 KW.



Six-cylinder Universal  
12,500 watt series.

● America's broadest line of generating plants—backed up by 50 years' designing and building experience. There are Universal models for all power requirements, with sizes ranging from one to six cylinders—250 to 25,000 watts, AC or DC. All types of controls—manual to fully automatic—for portable, emergency or stationary service.

Universal Electric Plants are of "Matched Unit" construction—assuring perfectly balanced units. This means engine, generator, cooling system, etc., are matched exactly to each other for maximum reliability—long, economical service.

Thousands of Universals are in use on every kind of powering job. Let a Universal Engineer specify the type and size best suited to your requirements. Write today.

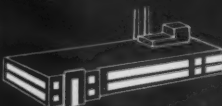
Qualified Contractors are invited to write for details on representing the complete Universal line. Desirable territories open.

## UNIVERSAL MOTOR COMPANY

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438 UNIVERSAL DRIVE • OSHKOSH, WISCONSIN

RADIO TRANSMITTERS



FACTORIES



FLOODLIGHTING



HOSPITALS



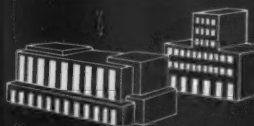
GAS STATIONS



SCHOOLS



REFRIGERATED TRUCKS



PUBLIC BUILDINGS



CONSTRUCTION CAMPS



Relaxing, via the amusing story route, at recent I.A.E.L. conference in St. Louis are: (L to R) Herbert E. Cook, Electrical Association of Detroit and W. G. Morrison, Essex Electric League, Newark, N. J.

loses and electrical inter-dependence works in reverse. Realizing this possibility, NEWA has embarked on a sales training course, details of which Mr. Pyle outlined briefly in his address.

Some of the finer points of trade association work as seen in the eyes of the law were reviewed by H. P. Fowler, manager, Trade Association Department, and general counsel, Chamber of Commerce of the United States, at the second session. Although no federal or state laws cover trade association as such, their activities may inadvertently come under scrutiny, he cautioned, as he went on to explain just where the thin dividing line lay.

### Lighting and Wiring

The Planned Lighting Promotional Program is a natural for Leagues, according to J. S. Schuchert, manager, commercial sales, Duquesne Light Company, Pittsburgh. Based on a survey of U. S. needs, he revealed the market to support such an activity as follows: Some 30,000,000 homes need four times more light; 100,000 office buildings, five times more; 258,000 schools, seven times more; 200,000 factories, four times more; 1,500,000 stores need six times more light. Normal fixture cost would be about \$1½ billion; with planned lighting, \$7½. Without planned lighting, wiring costs would run about \$½ billion; with planned lighting it would be about 3.1 billion dollars. Explaining the booklets, data, posters, and ad material contained in this program (EEIBL-BS Bureau), Schuchert urged the Leagues to become the sparkplug and prime mover in the activity.

Adequate Wiring promotion and acceptance is progressing at various rates in different localities. Brunt of this work is being done by League and utility personnel. Though not indicative



# ***LIGHT-IN-LINE*** ***Saves You Money...***

## ... IN EASE OF INSTALLATION

LIGHT-IN-LINE fluorescent lighting fixtures are superbly engineered . . . rigidly constructed. One man can easily install these super-efficient fluorescent fixtures with time and money saving results. Proven the outstanding value in usable foot-candles by E.T.L. data sheets, LIGHT-IN-LINE is top choice for hundreds of widely-varied commercial applications.

### "Basic Unit" Principle Featured

Made by Moe-Bridges, famous name in the lighting field for over quarter of a century, LIGHT-IN-LINE fluorescent fixtures feature the "basic unit" principle. Result: 16 smart-appearing combinations to meet the requirements of any lighting job with economy and satisfaction. Available with open, louvered or dustproof glass or plastic enclosed shields; single or continuous-row; 2-light and 4-light; 40-watt or 100-watt; with an added, exclusive feature of combining 40-watt and 100-watt in a single line for area intensification. Union-made and U.L.-approved. Write TODAY for complete information and E.T.L. data sheets. Address Dept. 711, Moe-Bridges Corporation, Sheboygan, Wisconsin.

### Toggle Bolts Installed First

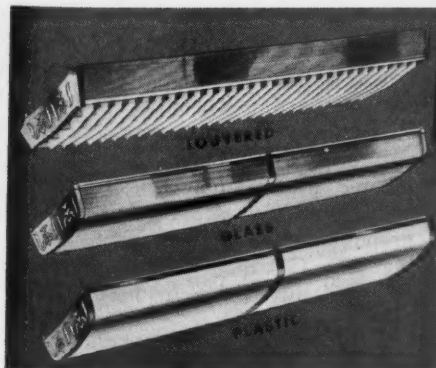
Then, LIGHT-IN-LINE base unit fixture is attached, toggle bolt head fitting through slotted opening. Gravity recess holds fixture securely, safely, allowing both hands to be used to tighten bolts.



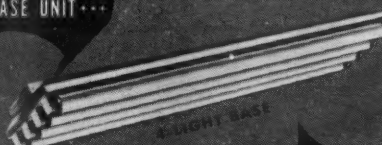
### ONE MAN CAN HANG LIGHT-IN-LINE FIXTURES

Toggle bolts or lead anchors are put in first, then, it's an easy job for one man to attach LIGHT-IN-LINE fixtures. . . . Perfect alignment of continuous-row lighting is guaranteed by installing bolts along chalk line before fixtures are hung.

# **MOE-BRIDGES** ***LIGHT-IN-LINE***

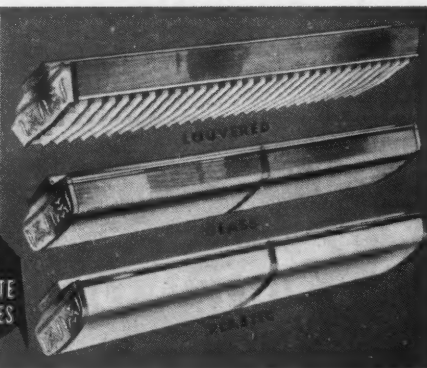


FIT SHIELDS  
ON THIS  
BASE UNIT...



ALSO AVAILABLE  
IN TWO-LIGHT  
40-WATT AND 100-WATT

.....TO GET  
THESE COMPLETE  
LIGHTING FIXTURES



OVER 25 YEARS LEADERSHIP IN THE LIGHTING FIELD



# Commutators!

FOR PROMPT  
SERVICE CONTACT  
YOUR NEAREST  
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**INSULATION  
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**TRI-STATE SUPPLY  
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318 Occidental Ave.  
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*Sales by Representatives  
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**AVAILABLE  
FROM STOCK...**

**REPAIR SHOPS...NOTE**

**A FACTOR OF PARAMOUNT  
IMPORTANCE WHEN PROMPT  
SERVICE IS ESSENTIAL**

**ALL TYPES**

**ALL SIZES**

**TO MEET YOUR  
REQUIREMENTS**

**SEND IN OLD CORES OF  
BOLT OR NUT TYPE  
CONSTRUCTION FOR REFILL**

**SPECIAL SIZES CAN BE  
MADE FROM YOUR SAMPLES  
OR SKETCHES**

**NEW CATALOG!**

**AVAILABLE  
SEND FOR YOUR COPY**

**List Complete Dimensions of All  
Types of Commutators**

**THE KIRKWOOD COMMUTATOR CO.  
1345 CARNEGIE AVE., CLEVELAND 15, OHIO**



*Albert L. Maillard (left), president and managing director, Electrical League of Indianapolis, learns about Chattanooga's adequate wiring program from Paul J. McMillan, secretary, Electrical League of Chattanooga.*

of a nation-wide condition, numerous reports indicate that the electrical contractor is not pushing adequate wiring. Some of the alibis: Price and additional supervision required on an AW job.

Reports from three different sections of the country highlighted the following problems:

*Southern California* (Victor W. Hartley)—Adequate Wiring can best be sold to individual home owner by talking economical and efficient operation. League must rely on utility personnel as sales force; contractors must be educated to support activity. Speculative builders do not set standards but follow pattern of owner-built homes. Home wiring is getting less of the building dollar (less than two percent) than ever before. Some local FHA authorities permit increase in existing good standards, hence work closely with them.

*Chattanooga, Tenn.* (P. J. McMillan)—League is re-educating the public, builder and contractor on AW advantages through numerous meetings, newspaper and billboard advertising. Consumer wants complete electric service but price is a real barrier—particularly when selling the group builder. League personnel recently sold Adequate Wiring to a builder of 400 homes after electrical contractor started minimum job.

*Detroit, Mich.* (B. H. Allen)—Additional cost of Adequate Wiring ranges from \$50 to \$300 per home in various sized units. Most speculative builders are waiting to see public reaction to Adequate Wiring before falling in line. Association AW Bureau is making intensive effort to have most of proposed 20,000 homes Certified Wiring jobs. Contractors hesitate because of added supervision required on AW jobs.

With price already a retarding factor to AW promotion, some areas of the country reported a newly discovered





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THE LIGHTOLIER  
STYLE BOOK

Here's the best selling tool in the lighting  
business. It's back again—bigger, better,  
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Use it for bigger fixture volume.



Show your customers better lighting and they'll buy better lighting. That's what the  
Lightolier Style Book is designed to do—to present a *complete line* of style-right,  
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It's your connecting link between our big advertising campaign  
and your cash register!

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Send me my advance copy of the Lightolier "STYLE BOOK."

Name..... Address.....

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**LIGHTOLIER**

DEPT. C5

JERSEY CITY, NEW JERSEY



# NEW AND IMPROVED RECESSED LIGHTING FIXTURES

# KENT

**Now Available for Immediate Delivery**



## NEW FEATURES NOW STANDARD

- Concealed Hinges
- Chrome Plated frame on Brass
- Plaster Frame built-in each fixture—saves framing-in
- Polished round aluminum reflector
- Asbestos lining not necessary with improved construction
- Approved by Underwriters Laboratories

## SPECIFICATIONS

Cat. No.	Box Size	Lamp Wattage
UL 708 FH	6 3/4 x 6 3/4	60 W
UL 709 FH	4 3/4 x 7 3/4	60 W
UL 710 FH	8 3/4 x 8 3/4	100 W
UL 712 FH	6 1/4 x 10 3/4	100 W
UL 714 FH	10 3/4 x 10 3/4	150 W
UL 716 FH	12 3/4 x 12 3/4	200 W

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*assures you of master craftsmanship in accordance with KENT TRADITION.*

WRITE  
FOR BULLETIN

## KENT METAL MANUFACTURING CO., INC.

490 Johnson Ave.

BROOKLYN 6, N. Y.

obstacle: The insistence of some municipal electrical inspectors that local ordinances be passed requiring conduit or metallic tubing wiring systems in homes. This is being questioned as a pure safety measure and is viewed as a "make work" move that may seriously hamper adequate wiring acceptance.

## Appliance Market

Based on a personal interview survey of numerous dealers throughout the country, A. P. McNamee, manager, appliance department, *McCall's Magazine*, presented these interesting observations:

Dealers' stock situation is improving but badly unbalanced with few, if any, items within means of people in moderate circumstances. Manufacturers should produce heavy appliances of functional design without frills. Too much merchandise from manufacturers requires immediately servicing. Manufacturers tie-in sales tactics irritate dealers.

Black market operators—selling appliances on an immediate delivery basis "at a price"—are getting big manufacturer franchises. Despite the beginning of a buyer resistance, few dealers have or plan to have an outside selling organization.

One sales executive of a merchandising utility expects the bottom to drop out of the appliance market within eight to ten months.

As for the market situation with respect to specific items, Mr. McNamee sees the following:

Flat irons, radios, broilers—market cluttered.

Refrigerators—still a terrific market, deliveries 2 wks. to 3 mo., most interest in dual-temperature model.

Home Freezers—market cluttered with unknown brands, disappointing sales.

Automatic Washers—available for immediate delivery, under high price burden.

Electric Sinks (garbage disposal unit)—Plumbers are charging from \$25 to \$200 to install the unit. Some city sewage systems lack capacity to handle added waste.

As for the overall picture—1946 statistics reveal that more than two-thirds of the U. S. population have less than \$3,000 annual income. Pit that against the present HCL and you have an answer.

## Farm Markets

As goes Agriculture, so goes your business, stated Frank Watts, executive assistant, *The Farm Journal*, New York. Cash marketings for agriculture in 1946 was \$28 billions; farm income in 1947 is expected to reach \$32 billions. Farmers have \$19 billion in banks



# SEVEN-STORY BUILDING GROWS 14 FLOORS TALLER

## General Electric Q-Floor Wiring System Selected to Meet All Present and Future Requirements

Now nearing completion in Houston, Texas, is an addition to the National Standard Building that will make it 21 stories tall and, at the same time, provide the complete electrical flexibility of General Electric Q-Floor Wiring with Robertson Q-Floors. This addition to the former seven-story structure was possible only with lightweight Q-Floors, which have the extra advantage of including raceways for power, telephone, and other services right in the floors as they are laid.

### Q-Floors Are Quickly Installed

Because Q-Floors are made in large sections, and can be laid as soon as the steel framework is completed, they contribute immensely to the speed of erection of any structure. The Q-Floor, once in place, becomes a working platform for other trades employed on the same job.

### G-E Wiring Keeps Buildings Electrically Young

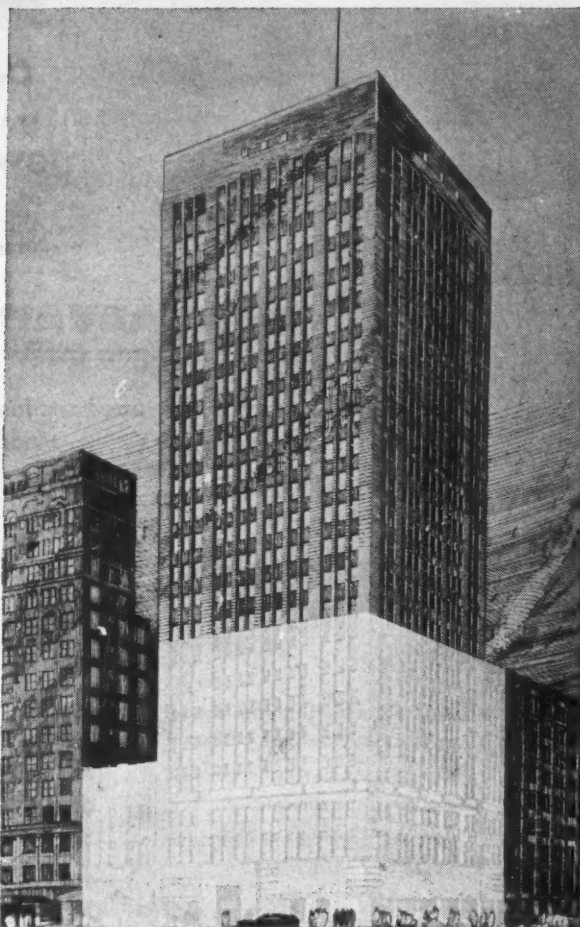
Buildings equipped with General Electric Q-Floor Wiring never become electrically obsolete. At any time during the life of the structure, new wiring can be added, or circuits removed, without tearing up floors or interrupting tenants' activities. It's easy to tap an outlet into Q-Floors — anywhere on six-inch centers.

For further information on General Electric Q-Floor Wiring, write (on your letterhead) for a free copy of the *Q-Floor Wiring Data Manual* — address Section C73-1118, General Electric Company, Bridgeport 2, Connecticut.

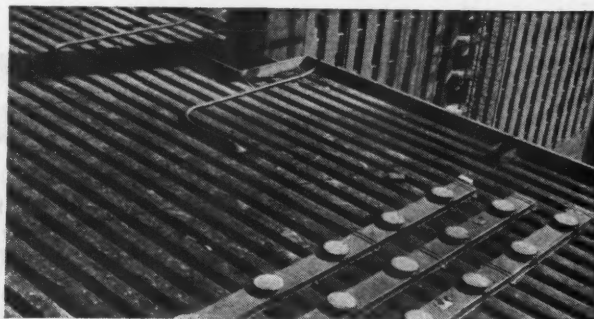
*Q-Floor is manufactured only by the H. H. Robertson Company, Pittsburgh, Pa. Samples can be seen at any G-E Construction Materials or Robertson District Office.*

#### CONSTRUCTION DATA

Architect: A. C. Finn  
Structural Engineer: Robert J. Cummins  
Mechanical Engineer: Reg F. Taylor  
Building Engineers: W. S. Bellows Construction Company  
Electrical Contractors: Fischbach and Moore of Texas



Growing from seven stories to 21 stories in a comparatively short time, the National Standard Building in Houston, Texas, will be electrically flexible with General Electric Q-Floor Wiring.



G-E Q-Floor Wiring utilizes the cells in Robertson Q-Floors, as electrical raceways. With Q-Floors, construction is speedy and simple, wiring changes economical, quick, and clean.

# GENERAL ELECTRIC





## "Frahm" RESONANT REED TACHOMETERS

### Check THESE ADVANTAGES

- **ACCURATE**, because the tuned reed is a natural resonant indicator.
- **DEPENDABLE**, because permanent calibration is a natural characteristic of tuned reeds.
- **STURDY**, because there are no delicate pivots, jewels or moving parts.

and these . . .

**EASY-TO-READ** vibrating reed-tips form a clearly defined pattern.

**LITTLE MAINTENANCE** is a result of simple, sturdy construction.

**LOW INPUT POWER** is sufficient to actuate the reed comb.

**OPERATE IN ANY POSITION** without affecting accuracy.

**ORDINARY ROOM TEMPERATURE VARIATIONS** HAVE LITTLE EFFECT on calibration.

**OPERATE WITHOUT DIRECT CONTACT** with moving parts under test.

**EASY TO OPERATE . . .** may be held against or mounted on machine.

Frahm Resonant-Reed Tachometers in round, rectangular and miniature types are available in ranges between the limits of 900 and 100,000 rpm or vpm. Made for permanent mounting on turbines, generators, motors, blowers, centrifugal pumps, diesel-electric installations, etc. Made also in hand types for a wide variety of uses. Write today for Bulletin 1810-EC.

### "FRAHM" Resonant-Reed FREQUENCY METERS

. . . operate on the same unique principle as Frahm Tachometers except that reed vibration is produced electrically instead of by direct mechanical contact. Available in switchboard, miniature and portable types for ranges between 15 and 500 cycles per second. To meet special requirements, we are equipped to build instruments for measuring frequencies as high as 1400 cps. For complete information write today for Bulletin 1770-EC.



## JAMES G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS  
1316 ARCH STREET • PHILADELPHIA 7, PENNA.

and are carrying around a collective roll of of \$3 billion. We cannot discount the terrific impact of this situation on today's business, Watts asserted.

The consensus of the best authorities is that farm production costs can be cut as much as 50 percent by improving output per unit of manpower, land and livestock. This opens a vast market for an aggressive farm electrification program. Of the 5½ million farms that can be electrified, 3,750,000 will have service by the end of this year; 800,000 are within a quarter mile of a high line. This vast market offers the electrical industry appliance and equipment sales of 1½ million dollars every day for the next ten years—or an average of about \$85 per farm, Mr. Watts estimated. Electrical leagues should study the possibility of having suburban dealers reach out into the rural areas to tap this potential, he concluded.

Following the theme that everything must be sold, John A. Morrison, managing director, Electric Association of Philadelphia reminded the group that the Quaker City is continuing to keep the electrical industry in the minds of the people. This time it's through a new electric kitchen and planning center with 21 manufacturers and distributors participating in the elaborate exhibit which has a full time staff of five men and a home economist. Just recently opened, no results have as yet been compiled.

Electrical maintenance engineer associations are an important activity in many leagues. Operation of a highly successful unit on the west coast was described by E. S. Reichard, president, Electrical Maintenance engineers Association of Southern California, Los Angeles. One service his members get is a monthly technical data sheet containing information not found in hand books. Reichard's hope is that enough EME's will spring up that they can form a national association.

There is need for more human engineering in the world today according to M. I. Pickus, president, The Personnel Institute, Inc. With the tremendous selling job we anticipate, we'll have to motivate people and be able to hire the right person for the job we have to do. Application of scientific methods can save a lot of time and trouble, he believes.

People today are questioning everything, even our business and government operations. We truly have to sell everything, even our free enterprise system, stated A. L. Scaife, General Electric Company. G. E.'s contribution to this is a sound-slide film depicting the development of our free enterprise system. Two of the series were shown by Mr. Scaife. Others will follow in



# HERE

are the handiest  
**CABLE CONNECTORS**  
that have ever been offered  
to America's busy  
Electrical Contractors!

No locknuts to fuss with!  
It's a simple job, with  
extra working space  
needed by man-sized  
fingers.

# HERE

is the 3-step  
explanation of  
how to use TOMIC  
CABLE CONNECTORS!

One—TIP in the Top.  
Two—SLIP the cable  
through. Three—FLIP  
the screws tight. And  
that's all, brother!

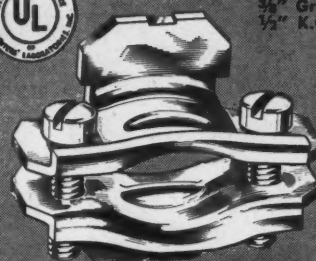
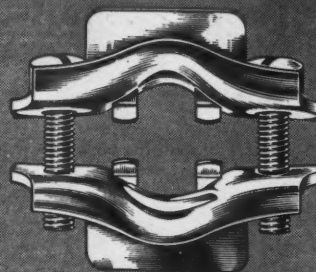
# HERE

is the coupon  
to fill out for  
free samples (with  
descriptive literature)!

Every day more and more contrac-  
tors demand Tomic Cable Con-  
nectors. For your next job, insist on  
Tomic!

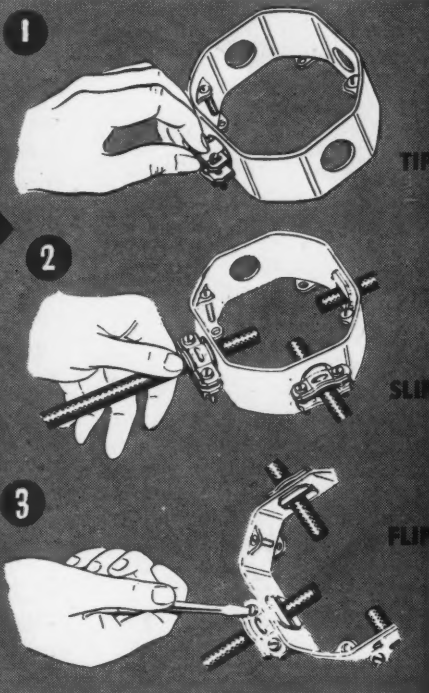
## Tomic Sales & Engineering Co.

4864 Woodward Ave. • Detroit 1, Michigan



New No. 333BX Ca-  
ble Connector (also  
3/4" Greenfield) for  
1/2" K.O.

No. 100 Romex Connector for  
1/2" K. O. or No. 200 Range  
or Service Entrance Con-  
nector for 3/4" K. O.



TOMIC SALES AND ENGINEERING CO.  
4864 Woodward, Detroit 1, Mich.

Please send me samples and data on Tomic  
Cable Connectors.

Name \_\_\_\_\_

Address \_\_\_\_\_

City & State \_\_\_\_\_





# KLEINS

## ...FOR THE MAN ON THE POLE

On emergency jobs . . . on tough jobs . . . on routine jobs . . . the men who string and maintain the nation's power and communication lines rely on Kleins. Wherever you see linemen you'll see Kleins—pliers and wrenches, tool belts and safety straps, climbers and grips.

There's a sound reason for this preference. For linemen and electricians—men who know good tools—also know of the quality materials and expert craftsmanship that go into every piece of Klein equipment. To them this excellence means safety, efficiency, speed . . . on every job.

Today Klein is in production on its complete line of quality equipment. Of course, demand still exceeds supply—but your supplier will furnish the Klein equipment you need just as soon as possible.

### ASK YOUR SUPPLIER

Foreign Distributor:  
International Standard Electric Corp.,  
New York

*The Klein Pocket Tool Guide showing the Klein line and containing useful information will be sent on request.*



Klein Pliers



Klein-Line Tool Belts



Klein-Kord Safety Straps



Klein Climbers



Since 1857

**Mathias KLEIN & Sons**

Established 1857

Chicago, Ill., U.S.A.

3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

this program to re-educate ourselves in our American business philosophy.

At the conference business session the following officers were elected: President—S. E. Strunk, secretary, Electrical League of Cleveland; Vice-president—J. Clark Chamberlain, secretary-manager, Bureau of Radio and Electrical Appliances, San Diego, California; treasurer—A. H. Kessler, manager, North Central Electrical Industries, Minneapolis; secretary—O. C. Small, manager, Business Development Department, NEMA, New York City; assistant secretary—J. F. Biggi, Business Development Department, NEMA, New York City.

Elected to the Board of Governors were: J. G. Waddell, Boston; J. J. Dore, Omaha, Nebraska; Victor W. Hartley, Los Angeles, Calif; G. W. Austen, Toronto, Canada; C. G. Odell, Detroit, Mich.; and P. L. Heath, Pittsburgh, Pennsylvania. Retiring president W. G. Hills of Washington, D. C., became advisory member to the Board.

## Electric Heating Conference

First of a series of four one-day industrial electrical equipment conferences and exhibits sponsored by the industrial section of the Electric League of Western Pennsylvania was held in Pittsburgh, October 13. This meeting featured exhibits of induction, infrared, resistance heating equipment for industrial use.

The program is intended to acquaint industrial leaders with industrial electrical equipment now available to increase production and cut costs.

In addition to the electric heating conference just held, future conferences are scheduled for March and January on Lighting and Material handling. A fourth conference will be held in May.

The Electric League of Western Pennsylvania is an organization of electrical manufacturers, contractors, wholesalers and utilities in the area of Pennsylvania west of Altoona devoted to advancement of the electric art.

## DATES AHEAD

National Electronic Conference—Edgewater Beach Hotel, Chicago, Ill., November 3-5.

American Institute of Electrical Engineers—Midwest meeting, Chicago, Ill., November 3-7.

2nd International Lighting Exposition—Hotel Stevens, Chicago, Ill., Nov. 3-7.

National Metal Trades Association—Palmer House, Chicago, Ill., November 6-17.

Lighting Show—Lighting Equipment Manufacturers Group of the Electrical Association of Philadelphia, Edison Building, 900 Sansom St., Philadelphia, Pa., November 18-20.

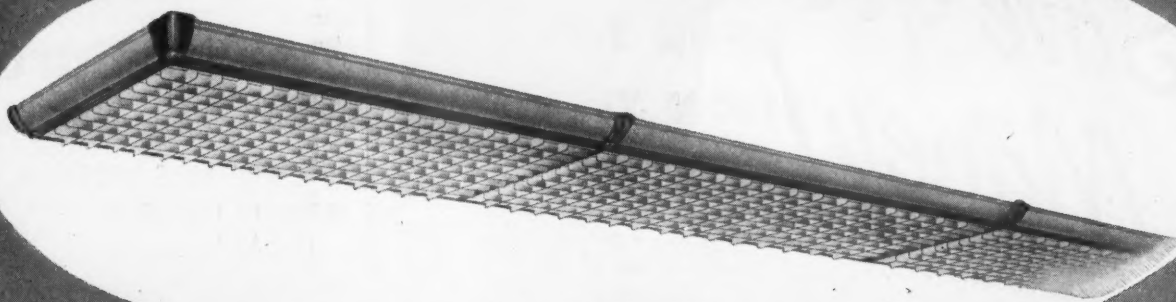
National Association of Manufacturers—Waldorf-Astoria Hotel, New York, N. Y., December 3-5.



# Slimlite

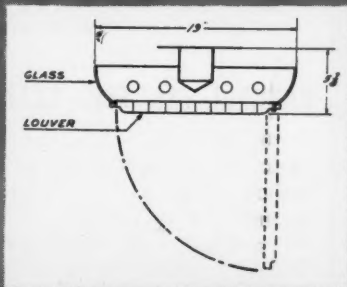
**ANOTHER EXCLUSIVE  
FIXTURE BY . . .**

## GLOBE



KG 108-8—CONTINUOUS

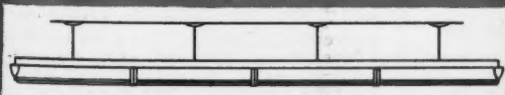
**Introducing "Slimlite,"** Globe's new sales leader, with new selling features — new in design . . . in beauty . . . in lighting efficiency.



**VERSATILITY . . .** You'll find "Slimlite" versatile. It can be used as a single unit, or as multiple units in a continuous mounting. And "Slimlite" is designed so that it can be placed flush against the ceiling or suspended at any height by means of beautifully ornamented suspension rods.

**GLASS ON 4 SIDES . . .** Globe's formed Glarex glass, made in its own glass factory, "Ceramized" by a special Globe process, enclosed "Slimlite" on all 4 sides, making for an unusually effective light distribution . . . as well as increased beauty.

**SPOT LIGHTS AVAILABLE . . .** If desired, double spotlights may be placed within each unit to achieve unusual dramatic effects. And for convenience in servicing, the louvre has been divided into 2 sections, both hinged, so that they may easily be lowered. "Slimlite's" versatility makes it easily adaptable to a wide range of interiors.



### GLOBE

**LIGHTING PRODUCTS, INC.**

*Established for over a quarter century*

16 EAST 40th ST., NEW YORK, N. Y.  
21st ST. & MAIN, LOS ANGELES, CAL.



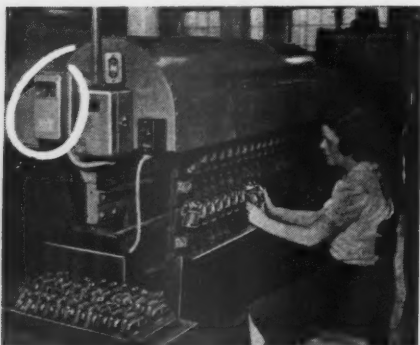


Let this  
  
 Time Switch  
 Save You  
 Money!



**Type T-27 helps reduce waste  
 . . . . increase profits**

Guessing at the timing of industrial processes often results in waste, poor quality, and loss of time and money. By letting the General Electric T-27 time switch handle these jobs you can prevent losses and help lower manufacturing costs. And lower costs mean added profits.



Here a T-27 controls movement of a chain conveyor through an electric oven—one of a complex cycle of time-switch-controlled operations in the manufacture of meter coils.

The T-27 is a versatile time switch equipped to handle a variety of jobs. Use it to turn ovens "on" and "off" at exactly timed intervals . . . to operate ventilating fans and blowers . . . to turn heating units on early so that they will be ready for use when workers arrive. Or let it control drying and curing processes after hours, without the attention of an operator.

It can do these and dozens of other timing jobs for you tirelessly and efficiently. It is a COMPLETE time switch . . . "complete" in that it is designed to handle almost any type of time-control assignment. Put the T-27 to work for you and benefit from the added economies. Ask the nearest G-E Office for further information, or write for Bulletin GEA-3339. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

**GENERAL  ELECTRIC**

603-49

**National Materials Handling Exposition**—Public Auditorium, Cleveland, Ohio, January 12-16.  
**Fifth All Industry Refrigeration and Air Conditioning Exposition**—Public Auditorium, Cleveland, Ohio, January 26-29.  
**American Institute of Electrical Engineers**—Winter general meeting, William Penn Hotel, Pittsburgh, Pa., January 26-30.  
**8th International Heating and Ventilating Exposition**—Air Conditioning Exposition, Grand Central Palace, New York, N. Y., February 2-6.  
**National Electrical Manufacturers Association**—Winter Convention, Edgewater Beach Hotel, Chicago, Ill., March 14-18.  
**Chamber of Commerce**—Annual meeting, Washington, D. C., April 27-29.  
**National Electrical Wholesalers Association**—Annual convention, Statler Hotel, Buffalo, N. Y. First week in May.  
**Edison Electric Institute**—Annual Engineering Meetings, Edgewater Beach Hotel, Chicago, Ill., May 3-5.  
**National Fire Protection Assn.**—Annual meeting, Statler Hotel, Washington, D. C., May 10-13.  
**Edison Electric Institute**—Annual convention, Atlantic City, N. J., June 2-4.  
**Illuminating Engineering Society**—National Technical Conference, Boston, Mass., September 20-24.  
**National Electrical Manufacturers Association**—Traymore Hotel, Atlantic City, N. J., November 8-13.

## Manufacturers News

### APPLETON BUYS GOODRICH ELECTRIC COMPANY

Goodrich Electric Company of Chicago, manufacturers of floodlights and industrial lighting equipment, has been purchased by the Appleton Electric Company, also of Chicago.

The Appleton Electric Company will continue the manufacture of the entire Goodrich line, and will improve and expand the line as rapidly as conditions permit, Murray J. Whitfield, Appleton vice president said. The Goodrich manufacturing operations will be moved from the present plant at 4600 Belle Plaine Avenue to the main Appleton plant at Wellington Avenue and Paulina Street, which recently has been enlarged.

### GENERAL ELECTRIC CHANGES


General Electric's Apparatus Department is establishing a new "integrated operating unit form of management to provide for expanded production," it was announced by R. C. Muir, vice president and general manager of the department.

The new organization, Mr. Muir said, consists of separate operating units, each with a manager responsible for all phases of business, including engineering, manufacturing and sales.

Simultaneously, Mr. Muir appointed 15 unit managers and a new manager for the Fort Wayne, Ind. Works. Managers of apparatus department works in Schenectady, N. Y.; Lynn, Mass.; Erie, Pa., and Oakland, Calif. will continue in their present positions. The unit manager of the business situated at each of the other apparatus works will have direct supervision of that works.

For coordination of sales and serv-



The ORIGINAL  SAW For Every Purpose

# MISENER

ROTARY HACK SAW

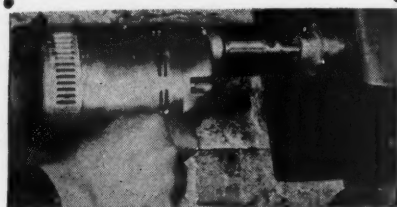


Graduated Fractional Diameters  $\frac{1}{8}$ " to 15"

Blade Depths  $\frac{1}{4}$ " to 24"

## CUTS YOUR COSTS OF CUTTING HOLES

- on machine production.
- on installation and factory maintenance jobs of all kinds.



Increases the range of a  $\frac{1}{2}$ " electric drill to  $\frac{3}{4}$ "



Increases the flexibility of single and multiple type drill presses.



Speeds up cutting of holes and grooves on lathes and other power machines.

Send for this **FREE FOLDER**

Presents fastest, lowest cost method of cutting clean, finished holes in SHEET METALS, CASTINGS, WOOD, PLASTICS, FIBER, TILE and other materials.



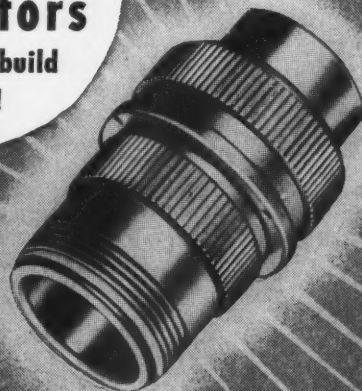
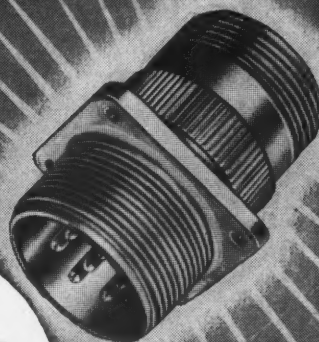
**MISENER MFG. CO., INC.**

314 So. Franklin Syracuse 2, N. Y.

# Bendix-SCINTILLA

## The Finest Electrical Connectors

Money can build or buy!



## AND THE SECRET IS SCINFLEX!

Bendix-Scintilla\* Electrical Connectors are precision-built to render reliable peak efficiency—day-in and day-out even under difficult operating conditions. The use of Scinflex—a new Bendix-Scintilla developed dielectric material—makes them vibration-proof, moisture-proof, pressure-tight, and materially increases flashover and creepage distances. Even under extremes of temperature—from  $-67^{\circ}$  F. to  $+300^{\circ}$  F.—their performance is remarkable. Dielectric strength is never less than 200 volts per mil.

The contacts, made of the finest materials, carry maximum currents with the lowest voltage drop known to the industry. These truly superior connectors belong on every job where there is no compromise with quality. Check the list of outstanding features below.

\*TRADEMARK

Write for detailed information.

- Moisture-proof, Pressure-tight • Radio Quiet • Single-piece Inserts
- Vibration-proof • Minimum Weight • High Arc Resistance
- Easy Assembly and Disassembly

Available in all Standard A-N Contact Configurations.

SCINTILLA MAGNETO DIVISION of

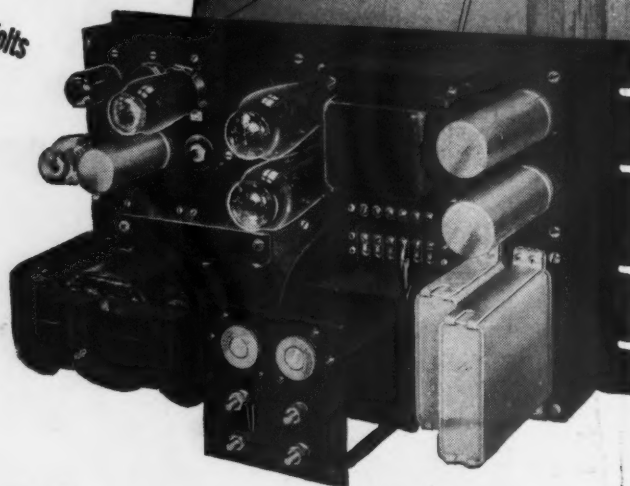
SIDNEY, NEW YORK





Do you really know  
the **VOLTAGE**  
**CONDITIONS**  
in your plant ?

208 Volts  
195 Volts  
220 Volts  
115 Volts  
255 Volts



To correctly answer this question is difficult. Your utility may quote a nominal voltage . . . but, by law, most power suppliers have up to  $\pm 10\%$  tolerance. This condition plus changing loads in your own plant results in voltages other than the nominal. Only by engineered control can you be sure that line voltage will remain constant.

With a STABILINE Automatic Voltage Regulator in the power line, your electrical apparatus is assured of constant voltage.

Type IE . . . these all-electronic regulators provide instantaneous action in maintaining the delivered voltage to within  $\pm 0.1$  volts of the preset value regardless of line variations. For any load current change or load power factor change from lagging .5 to leading .9, type IE will hold the output to  $\pm 0.15$  volts. Maximum waveform distortion never exceeds 3%.

Type EM . . . for large size installations where low cost and high efficiency are paramount considerations but instantaneous action is not essential, type EM regulators find wide application. These units have zero waveform distortion; are not affected by changes in the power factor or magnitude of the load; and the regulator does not affect the power factor of the system.

Further information is available in Bulletin 547. Write for your copy.

Write **SUPERIOR ELECTRIC**, 1112 Laurel Street, Bristol, Conn.

**THE SUPERIOR ELECTRIC CO.**  
BRISTOL, CONNECTICUT



Powerstat Variable Transformers • Volthox A C Power Supply • Stabiline Voltage Regulators.

ice activities on an industry wide basis, separate groups of sales, application, construction and service engineering divisions will continue as a part of the general office. The Apparatus Department sales office will continue its present form of operation.

R. S. Neblett, manager for the past two years of the Federal and Marine Divisions, G-E Company, has been named administrator of the company's Nucleonics Project, which consists of work on atomic energy for the U. S. Atomic Energy Commission. Bruce R. Prentice, who has been serving as staff assistant to H. A. Winne on Nucleonics Project work, has been named assistant to Mr. Neblett.

W. W. Hollo has been appointed G-E representative for wire and cable in the New York district.

### PAUL J. MOORE JOINS CROCKER-WHEELER

Crocker-Wheeler Electric Manufacturing Company of Ampere, N. J., a division of Joshua Hendy Corporation, has announced the appointment of Paul J. Moore to the newly created position of director of sales and engineering.

Mr. Moore was formerly connected with the motor engineering and sales



**P. J. MOORE**

departments of General Electric Company, Schenectady. He was subsequently sales manager of Imperial Electric Company, Akron, Ohio; manager of sales and engineering of Star Electric Motor Company, Bloomfield, N. J. and manager of commercial department of Watson-Flagg Machine Company, Paterson, N. J.

### SQUARE D ESTABLISHES GENERAL SALES DEPARTMENT

F. W. Magin, president of the Square D Company, has announced the formation of a general sales department to coordinate sales promotion, advertising and overall sales policies of the Company's electrical divisions.

L. W. Mercer, vice president, will serve as general sales manager under the new plan and will also continue as general manager of the switch and panel division in Detroit.

F. H. Roby has been appointed assist-



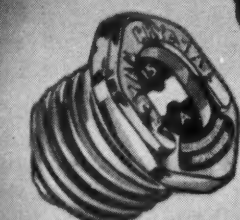
# ROYAL



ROYAL-NOARK  
Non-Renewable  
CARTRIDGE FUSES



ROYAL-NOARK  
Renewable FUSES



ROYAL "Crystal"  
the original glass-top fuse



# ROYAL FUSES

ROYAL ELECTRIC CO., Inc.  
PAWTUCKET, RHODE ISLAND

Extra Rugged . . . Extra Long Life!



Wire with  
**PORCELAIN**  
Service-Proved WIREHOLDERS!

Here's another example of better service with PORCELAIN protected wiring! With Porcelain Products Service Wireholders, there's a double advantage: (1) *extra strength* to insure long life of trouble-free service; (2) *neat appearance* on any building. All metal parts are rust-resistant. Designed and built to same standards of quality as high tension insulators. Dependable... utmost satisfaction all along the line—for wholesaler, contractor and consumer. Ask your Electrical Inspector about non-metallic wiring with Porcelain for safety. Write for wiring manual.



**PORCELAIN**  
**PRODUCTS, Inc.**  
FINDLAY, OHIO

Wire Today for Tomorrow's Load



FULLMAN

# Latrobe PRODUCTS

★ FLOOR BOXES ★



★ WIRING SPECIALTIES ★

## DEPEND ON "LATROBE"

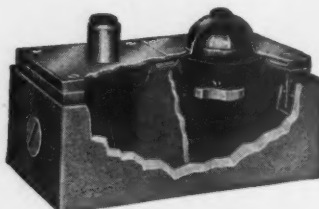
Depend on "Latrobe" floor boxes and wiring specialties to give 100% performance at all time.

"Latrobe" products are easily and quickly installed. They are adaptable, efficient and economical.



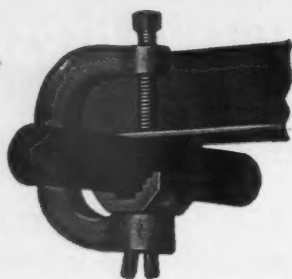
**No. 110 "Latrobe"  
Watertight Box**

Trouble-free, economical, easily installed in concrete or wood finished floors. Shown with No. 207 Nozzle.



**No. 252-R Floor Box**

Two gang, adjustable type with No. 208 Receptacle in one section. 1/2" Brass Plug in one cover plate and 2" Brass Plug in the other.



**No. 470 "Latrobe"  
Pipe or Conduit Hanger**

A convenient, sure-grip device specially designed for hanging 1/2", 3/4" and 1" pipe or conduit to steel beams up to 3/8" thick.



**No. 284 Nozzle**

For quick installations and long, efficient service, here is a Duplex Receptacle Nozzle with a Brass pipe extension. 1/2" or 3/4" pipe extension.



**"Bull Dog"  
B X Cable Staples**

Millions of these high quality staples are giving dependable service in all parts of the U. S. Packed in cartons, kegs, or barrels.

**Sold Only  
Through  
Wholesalers**



**"Bull Dog"  
Insulator Support**

Safe and sure for fastening porcelain or glass insulators to exposed steel framework. Four sizes.

**FULLMAN MANUFACTURING CO.**  
**LATROBE . . . PENNSYLVANIA**

ant general sales manager, responsible for overall coordination of field activity, advertising and sales promotion. For the present he will continue his current assignment of sales manager of the industrial controller division in Milwaukee. Offices will be maintained in both Detroit and Milwaukee.

C. L. Hull will continue his assignment as merchandise sales manager responsible for distribution activities pertaining to power and lighting distribution equipment and industrial control, as well as sales manager of the switch and panel division.

Headquarters for sales activity in the 11 Western states will continue at Los Angeles under J. H. Pengilly, vice president and general manager of the Western division.

## C. T. BUTTON WITH HOWELL ELECTRIC

The Howell Electric Motors Company, Howell, Mich., have announced the appointment of Charles T. Button as general sales manager.

Mr. Button was graduated from the University of Cincinnati in 1925. He then joined the Holtzer-Cabot Electric



**C. T. BUTTON**

Company in Boston, Mass. and later was appointed assistant general sales manager.

In 1944, he joined the Master Electric Company, Dayton, Ohio, as sales manager of the electrical controls division and assisted with the development and sales of motor control equipment.

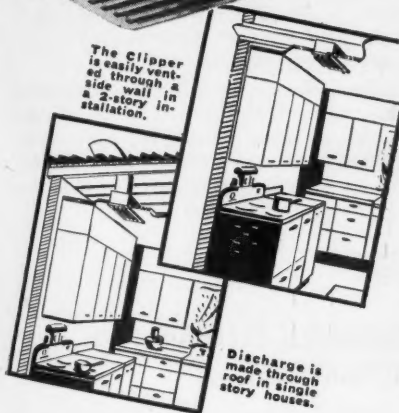
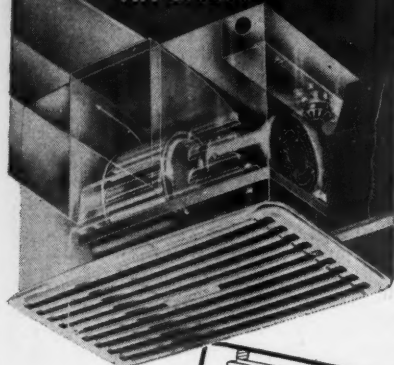
## WESTINGHOUSE APPOINTMENTS

John E. Payne, formerly manager of industrial sales, has been named manager of all industry sales departments for the Westinghouse Electric Corporation, with general overall responsibility for sales of equipment to all industries.

R. S. Kersh, who has been manager of the company's Houston, Texas, office since 1942, was named manager of industrial sales to succeed Mr. Payne. Both men will be located at the Westinghouse East Pittsburgh, Pa. plant.



## THE BEST VENTILATION FOR NEW OR OLD KITCHENS



### TRADEWIND CLIPPER BLOWER

**T**HIS proven method of ventilating home kitchens and other small rooms traps heat, grease and odors the instant they rise and expels them out-of-doors. Clipper Blowers offer two vital advantages:

1. They are located in the ceiling directly above the stove — where the heat and smudge first collect.
2. The motor in the Clipper is completely separated from both the blower and the dirty air — an exclusive patented feature which has resulted in greater efficiency, longer life, easier servicing.

Study the sketches above. Clipper Blowers are quickly and inexpensively installed in the ceiling between joists and vented outside. Only an inconspicuous "dripless" ceiling grille is visible, yet motor and blower assembly are instantly removed without tools.

Ask your jobber for details of the Clipper Sales Plan or write us for complete information.

**TRADE-WIND MOTORFANS, INC.**  
5709 SO. MAIN ST., LOS ANGELES 37, CALIF.

## USE BRIEGEL ALL-STEEL INDENTER-TYPE FITTINGS!



Select the best, insist on Briegel All Steel Fittings, the only approved Indenter type connectors and couplings for thin wall conduit tubing. You will not only find that Briegel Indenter Fittings are easier and faster to use, but also make neater, stronger connections. Two Easy Squeezes and they're set. Start using Briegel Fittings today. Have more satisfied customers — more profits from each job.

#### DISTRIBUTED BY

The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Enameled Metals, Pittsburgh, Penn.; National Enameling & Mfg. Co., Pittsburgh, Penn.; Canadian General Electric Company, Ltd.



All B-M Fittings Carry the Underwriter's Seal of Approval and Canadian Standards Ass'n Approval No. 8275.

**NEATER • FASTER**

**STRONGER • APPROVED.**



**BRIEGEL METHOD TOOL CO.**  
GALVA, ILLINOIS



# Suggest a Time Switch...

## SPECIFY RELIANCE

• Every installation that calls for automatic control calls for a Reliance Time Switch. Completely automatic... easy to install... proved through 35 years of dependable service... Reliance Time Switches provide added volume for contractors and better service for users. You can rely on the Reliance line. Ask your distributor or write Reliance Automatic Lighting Co., 1937 Mead Street, Racine, Wisconsin.



## RELIANCE AUTOMATIC LIGHTING CO.

1937 Mead St. Racine, Wis.



"Badger" Heavy Duty Automatic Switches.



"Model-W" synchronous Automatic Switches.

## KOILED KORDS, INC. APPOINTS GRAYBAR NATIONAL DISTRIBUTOR

The Whitney Blake Company of New Haven, Conn., is now teamed with the West Coast interests of Ralph Collins and Charles F. Mason, in the ownership of Koiled Kords, Inc., successor to Cordage, Inc., according to an announcement made by John Brown Cook, president of the new company.

Simultaneously it was announced that the Graybar Electric Company has been appointed exclusive distributor of all Koiled Kord products except telephone retractile cords of which they will share the distribution with several telephone manufacturers.

Sales activities of Koiled Kords, Inc. are directed by Col. E. L. Love, formerly in charge of Koiled Kords, Division of Kellogg Switchboard Company in Chicago.

The officers are Charles Mason as chairman of the board, John Brown Cook, president, John H. Ingmanson, executive vice president, R. D. Collins, vice president and Basil Hostage, secretary and treasurer.

## TRUMBULL ELECTRIC APPOINTMENTS

The Trumbull Electric Mfg. Co. of Plainville, Conn. has announced the recent appointment of Frank M. Oglee of 1012 Beverly Road, West Hartford, Conn. as manager of employee relations, and the appointment of J. Warren Barry of 613 N. Hidaalgo St., Alhambra, Calif. as manager of the Company's California operations.

H. T. Powers will continue in his present assignment as personnel manager of the Plainville Plant.

## BENKERT AND DUER ENGINEERING COMPANY FORMED

In line with the expanding use of resistance welding in the East Central states, and in order to provide manufacturers in these states with the maximum amount of field and applications engineering experience in resistance welding, Louis M. Benkert and Paul Duer have announced the formation of Benkert and Duer, Incorporated.

The new organization will maintain three offices—at 4820 Olentangy Blvd., Columbus 2, Ohio; 859 Leader Bldg., Cleveland 14, Ohio, and 325 Bankers Trust Bldg., Indianapolis, Ind.

Mr. Benkert, who resigned as general sales manager of Progressive Welder Company and Paul Duer, who had been representing Progressive in Western Pennsylvania and Eastern Ohio, will make their headquarters in Columbus.

Art Johnson, who has resigned as

# SELL SAFETY...

for consumer protection and increased profits

WITH NEW

**NO-SHOK**

CONVENIENCE

OUTLET!



Promote SAFETY—prevent loss of life—with this accident-proof, heavy duty, NO-SHOK duplex receptacle. With its positive snap-back spring action, face is closed tight when plug is removed, thus assuring children and adults full protection from electric shock against which ordinary outlets cannot guard. Play safe—build sales, good will, and prevent tragic accidents.

Thick double walls of bakelite separating and insulating heavy duty terminals—lifetime spring action—firmer plug grasp, positive contact always.

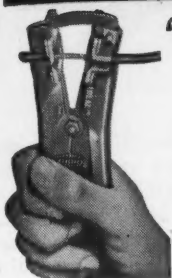


Listed as Standard by Underwriters Laboratories





## DO IT EASIER with IDEAL TOOLS!



### "E-Z" HAND TYPE STRIPPER and CUTTER

Triple action—  
clamps wire, cuts  
insulation and  
strips fast and  
clean, all at once.

For stranded or solid wire. Blades  
replaceable. Eliminates wire waste.

### FISH TAPE, REEL and PULLER



Three tools in one.  
Speeds wiring, saves  
tape. Gives workmen  
complete control—keeps tape  
reeled up, enables him to avoid  
contact with "live" parts. Prevents  
slippage, kinks, bends, breaks.



### CABLE RIPPER

For use on non-metallic  
sheathed duplex cable  
or lead-covered cable.  
Cuts cleanly, quickly,  
easily—simply squeeze  
onto cable and pull. Gives long  
service.

### "SAFE-T-GRIP" FUSE PULLER

No slip!—"finger fit"  
assures positive grip.  
Eliminates danger in  
replacing cartridge  
fuses by hand.



Write for detailed information  
on these money saving tools.

**IDEAL INDUSTRIES, Inc.**  
Successor to Ideal Commutator Dresser Co.  
1041 PARK AVENUE • SYCAMORE, ILL.

**IDEAL** Distributed  
Through  
**AMERICA'S LEADING WHOLESALERS**

An Edge of 1 to 10  
is what

**SYNTRON**

DEPENDABLE

## ELECTRIC HAMMERS

give You, when

Drilling, Cutting  
and Chipping in  
Concrete and  
Masonry



Their powerful 3600 blows per minute  
will drill anchor bolt holes, or cut and  
channel for conduit just about 10 times as  
fast as you can do it by hand—cutting  
down job time and costs.

It will pay you to investigate these tools.  
Write to

**SYNTRON CO.**

690 Lexington, Homer City, Pa.

## THE NEW INDUSTRIAL ANALYZER



only **28.50**  
NET

The Model 247 comes housed com-  
plete in a beautiful hand-rubbed Oak  
Cabinet with removable hinged cover.

### SPECIFICATIONS:

A. C. Voltage Ranges—  
0 to 150/300/750 volts.  
A. C. Current Ranges—  
0 to 3/7.5/15/30 amperes.  
Resistance—  
0 to 20,000 ohms.  
Watts\*—  
0 to 300/750/1500/3000 watts—  
115v. line  
0 to 600/1500/3000/6000 watts—  
230v. line

\*Watts computed on the basis of Unity  
Power Factor.

**VOLTS • AMPERES  
RESISTANCE • WATTS\* • VARS**

### FEATURES:

- ★ Completely portable—No external  
source of current required.
- ★ Individual binding posts for each  
range reduces to absolute minimum  
the possibility of damaging meter.
- ★ Uses 4½" square rugged meter  
with large easy-to-read type.
- ★ All calibrations printed directly on  
meter.

## TRIANGLE INSTRUMENTS CO.

Dept. "C," 2937 West 36th St., Brooklyn 24, N. Y.

### CLIP COUPON

Triangle Instruments Co.  
2937 W. 36th St., Dept. "C," Brooklyn 24, N. Y.  
Please send.... Model 247 Industrial Analyzer.  
☐ Full payment \$.....enclosed.  
☐ C. O. D. plus charges.  
Name.....  
Address.....  
City..... State.....





## ADALET WEATHER-PROOF AND VAPOR-TIGHT FITTINGS

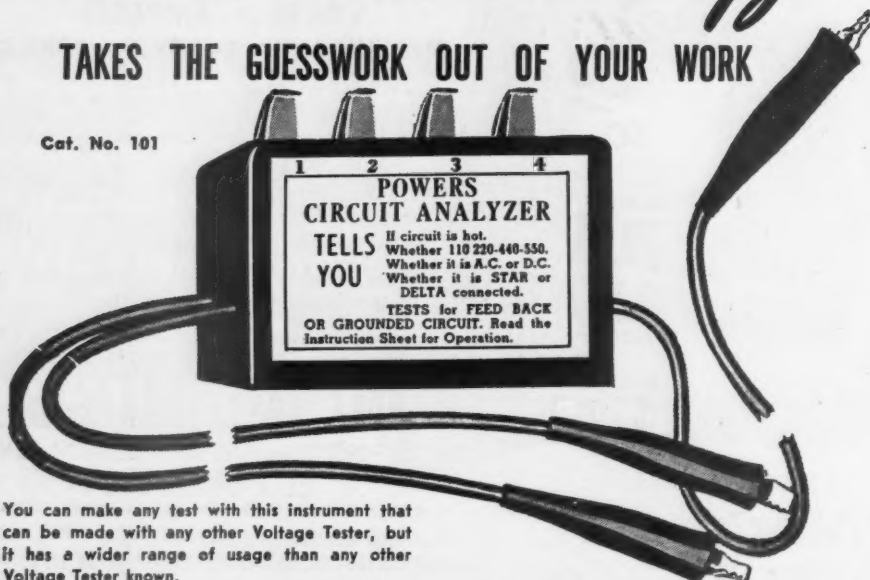
- ✓ Listed by U. L. for locations exposed to moisture or Non-combustible dust.
- ✓ Threadless type guard is mounted to fitting with unique locking device—will not vibrate loose.
- ✓ Universal hub arrangement; one fitting does all jobs. Either 4 or 5 tapped hubs available for any or all runs.
- ✓ Junction box is weather-proof even if globe is broken.
- ✓ Delivery: Stock, subject to prior sale.

*The* **ADALET**  
MANUFACTURING CO. 14300 LORAIN AVE.  
CLEVELAND 11, OHIO

## Powers Circuit Analyzer

TAKES THE GUESSWORK OUT OF YOUR WORK

Cat. No. 101



You can make any test with this instrument that can be made with any other Voltage Tester, but it has a wider range of usage than any other Voltage Tester known.

List Price Without Case \$14.40 List Price With Leather Case \$24.50

Approx. Dimensions 6" x 4" x 1½"

POWERS Products are sold through most all Electrical Distributors BUT if your local Distributor cannot supply you please write to factory for illustrated Bulletin and Descriptive matter.

**POWERS MANUFACTURING COMPANY**

1527 Folsom Street

San Francisco, California

Makers of Practical Equipment for use by Practical Men

chief electrical engineer of Progressive, will be in charge of the Indianapolis office, while George Omelianoff, also formerly with Progressive as applications engineer, will be in charge of the Cleveland office.

The new organization will represent Progressive Welder Company exclusively in Ohio, except Toledo, Western Pennsylvania, Northern Kentucky, West Virginia and most of Indiana.

### ADALET CHANGES

The Adalet Manufacturing Co. has moved to its new factory at 14300 Lorain Ave., Cleveland 11, Ohio.

C. C. Pierce Co., 241 Purchase St., Boston, Mass. has been appointed factory representative covering the entire New England territory.

Johan C. H. Larsen has been appointed factory representative covering Northern Ohio. He lives at 27158 Center Ridge Rd., Westlake.

### E. M. PAULLIN FORMS NEW COMPANY

Edward M. Paullin after 16 years with Worthington Pump and Machinery Corp. has resigned in order to form the Paullin Equipment Co., Inc. The new company, with offices at 28 Church Street, Buffalo, N. Y., will deal in new and rebuilt mechanical electrical equipment. The company will also act as consulting engineers and manufacturers agents.

Other officers in the company are John H. Darby, vice president and Glenn A. Irvin, secretary.

### GRAYBAR APPOINTMENTS

E. I. Funk has been named manager of supply sales in the St. Louis district of Graybar Electric Company.

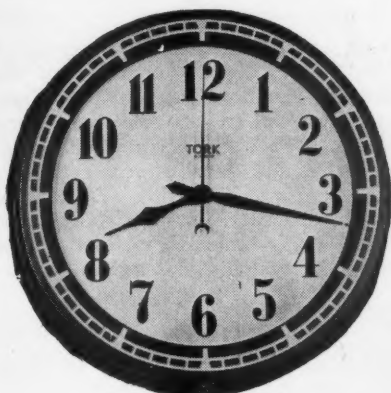
W. E. Greene, Jr. has joined the Little Rock branch as supply salesman, covering Northern Arkansas.

Electric Machinery Mfg. Company, of Minneapolis, announces the establishment of new sales offices at Seattle, Washington and Portland, Oregon. A. C. Petrich, Garland-Affolter Engineering Corp. at 532 First Avenue South, will handle the Seattle territory and George R. Schultz, Garland-Affolter Engineering Corp. at 1233 N. W. 12th Avenue, will handle the Portland territory.

Wally B. Swank, former sales manager of the E. F. Johnson Co., Waseca, Minn., has announced the formation of his own organization in Syracuse,



# "SAFETY-SET"



## WALL CLOCK

Really new! No more standing on chairs when resetting. Why risk broken limbs? With a cord or hooked stick, just a 1/4" pull on the little ring and the minute hand goes 300 times faster. Sets clock forward 1 hr. in only 12 seconds.

Reflectionless 14" dial; spun aluminum case, polished, or baked enamel in white, black or maroon; dustproof and washable.

Rugged self-starting synchronous motor; built for long service and reliability. 110 v. 60 c. A.C. Priced from \$15 list.



**TORK**  
CLOCK CO.

MT. VERNON · NEW YORK



"Paid for itself  
in 6 weeks"

SAYS USER R——OF HIS  
**UP-RIGHT SCAFFOLD**

**ALUMINUM ALLOY**

"Weighs Less than the User"

Erected in One Minute per Section

**INSTANT LEVELLING  
and HEIGHT ADJUSTMENT**

No Loose Parts

Each Section  
Folds Flat

**WRITE**  
for  
descriptive circular

**UP-RIGHT SCAFFOLDS**  
601 Bank of America Bldg.  
Berkeley 4, California



## DO YOU REPAIR ELECTRIC MOTORS?

**IF SO—WRITE NOW for the new  
HARCO 1947 CATALOG**



of complete up-to-date information  
on all makes of **ELECTRIC  
MOTOR PARTS, BEARINGS  
BRUSHES, CAPACITORS  
COUPLINGS and PULLEYS**

**LIMITED EDITION Due to Paper Shortage . . .  
WRITE FOR YOUR COPY AT ONCE!!**

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City-State \_\_\_\_\_

**HARCO EQUIPMENT CO.**

**2473 SHERMAN AVE., N. W., WASHINGTON, D. C.**





# INSULATED CONDUIT END BUSHINGS

*Molded of Impact Resistant Bakelite*



1. Threads are smooth, concentric and free of burrs.
2. Provided with ribbed grip for easy tightening by hand or tool.
3. Inside of lip beveled to remove cutting edges. Thus danger of injury to wire insulation is eliminated not only when wires and cables are "pulled" but after installation.
4. "Union" Insulated Conduit-End Bushings economically prevent costly grounds and short circuits. Particularly desirable in industrial locations. Vibration often damages wire insulation where sharp edges are contacted.

**Priced to Make  
Insulated Bushings Preferred**

*Compare!*



**UNION INSULATING CO., INC., Parkersburg, W. Va.**



Licensed under  
U. S. Pat.  
No. 2341520  
Others Pending

*For Performance!*

## MAGNO-TRONIC DUAL SILVER POINT ELECTRODYNAMIC FLUORESCENT STARTER

A precision built instrument of established merit incorporating the following features—starting reliability coupled up with a fully automatic circuit breaker that will cut out a deactivated tube from the circuit—no manual reset required to allow starter to perform all of the lamp starting functions when a good lamp is installed. Contacts are made of noble metal assuring longevity, durability and economy.

You'll find Industrial Electronics Corporation products in factories, office buildings, stores, railroad terminals, shipyards, schoolrooms . . . everywhere contributing to the comforts of American Life.

The (SP-15-20) for use with either 15 or 20 watt lamps

The (SP-30-40) for use with either 30 or 40 watt lamps

The (SP-100) for use with 100 watt lamps

*Ask for descriptive literature*

**INDUSTRIAL ELECTRONICS CORP.**

80 Bank Street



Newark, N. J.

N. Y., where he will represent the manufacturers of several lines of electrical and electronic equipment for all of New York state except New York City. His office will be at 400 Cherry Road, Syracuse 9, N. Y.

Robert J. Peck has been appointed New York district manager of the **Electric Products Company**, Cleveland. Mr. Peck will be located at 126 Liberty Street, New York City and will handle all sales and service negotiations in the territory, consisting of the New England states, Eastern New York and Pennsylvania, New Jersey, Delaware, Maryland and Virginia.

**John A. Roebling's Sons Company**, Trenton, N. J., has announced the appointment of H. S. Christie as manager of the Atlanta, Ga. branch office. He replaces C. G. Mullings, recently retired after 45 years of service in the Atlanta territory.

G. Edward Conn, Jr. has been named manager of the newly established **Allis-Chalmers** branch office at York, Pa.

MacGregor G. Jones, former resident representative at the Harrisburg branch office which has been discontinued, will assist Mr. Conn at York as sales representative.

**Rockbestos Products Corporation**, New Haven, has opened a Los Angeles district office. It is located at 6919 San Fernando Road, Glendale 1, Calif. and Warren S. Jones, formerly of the New Haven sales office, is in charge.

**Fluores-o-lite Co.** has moved to its new building at 7 Evans Terminal, North Broad St., Hillside, N. J. They were formerly located at 57 Branford St., Newark, N. J.

**Tempo Products Company** has moved to new quarters at 1900 Euclid Avenue, Cleveland. They were formerly located at 402 Perry Payne Building.

**S & C Electric Company**, Chicago, announces the appointment of H. A. Glover as assistant sales manager.

**Insulated Wire Co.**, Los Angeles, has opened a branch office and warehouse in San Francisco, Calif. The office is located at 204 Davis Street and the warehouse at 625 Second Street.



# MERCURY SWITCHES

are used in all Mercoird Controls. They assure better control performance and longer control life. That is why Mercoird Controls rate a very high percentage of customer satisfaction—a good reason for specifying—

# MERCOIRD CONTROLS



Dust, air, gases and moisture impair the efficiency and shorten the life of exposed electrical contacting surfaces.

Mercoird hermetically sealed mercury switches are immune to all of these switch damaging elements. The contacting surfaces remain constant in their efficiency, prolonging the life indefinitely.

Mercury switches bearing the registered trade mark name of "Mercoird" are not subject to open arcing, oxidation, corrosion, pitting or sticking of the contacting surfaces.

Mercoird switches are available to the trade in various designs, sizes and capacities.

There are numerous applications where these switches have a definite advantage over the open contact type switches.

Our engineers gladly offer their assistance in the adaptation of our switches to your switch problems.



**THE MERCOIRD CORPORATION**  
4201 BELMONT AVE., CHICAGO 41, ILLINOIS

**\*CONTROLS\***  
FOR HEATING, AIR CONDITIONING, REFRIGERATION  
AND VARIOUS INDUSTRIAL APPLICATIONS



with the  
**"OVERLAP LUG"**

**SAFETY  
FEATURE!**



All Simplet Hangers carry Underwriters' seal of approval.

The new K-100-N.Y. Friction-Set Fixture Hanger incorporates two new safety features that make it the most outstanding unit available. Added to the exclusive Friction-Set feature are the Hubbell Twist Lock, Solid Ground Receptacle, and the Stamped Lug Overlaps that take the weight off of outlet box screws by placing it on top of the outlet box ears (see illustration). K-100-N.Y. fits all 4" boxes, no other fastenings necessary. Furnished complete with two 5' chains, hooks and cord clips. List price \$2.35. Write for Bulletin giving complete information.

Patent Applied for.

**SIMPLET ELECTRIC COMPANY**

3600 W. Potomac Ave., Chicago 51, Ill.  
112 Charlton Street • New York 14, New York  
Manufacturers of Conduit Fittings—Vaportite Fixtures  
All Simplet products sold exclusively through wholesalers

Punched Overlap in cover rests on ear of outlet box.

Welded washers reinforce plate.



**THREE PENNIES IN POSTAGE** will bring you the answer to real cost reductions in marking wires, leads, circuits, relays, parts, etc. • As alert production, maintenance and repair men everywhere have discovered, **QUIK-LABELS** do the job better, faster and cheaper than string tags, roll tapes, decals, stencils, metal tabs, etc. • You can't afford not to look at **QUIK-LABELS**... particularly when a 3c stamp will bring you **FREE SAMPLES** by return mail. Clip that convenient coupon now.

**W. H. BRADY COMPANY—Identification Specialists—Milwaukee, Wisconsin.**

**W. H. BRADY COMPANY**  
801 N. 3rd St., Milwaukee 3, Wisconsin

Please send me **FREE** samples of **QUIK-LABELS**, the modern time and money saving way to mark wires, leads, circuits, relays, parts, etc.

Name \_\_\_\_\_

Position \_\_\_\_\_

Please attach to your **BUSINESS** letterhead



*Step down main circuit voltages*

## —with CHICAGO Power Circuit TRANSFORMERS

• **Convenience In Wiring** — Attached outlet boxes provide large, easily accessible wiring compartments for lead connections, take conduit or flexible cable from all 4 sides.

• **Flexibility In Mounting** — Units can be mounted as shown at right, up-side-down, or in any other position; rugged frames and mounting feet provide strong, rigid support.

• **Dependability In Operation** — Quality construction, with more-than-adequate insulation and vacuum impregnation of core and coil, assures long, service-free operating life.

*Write for prices and further details.*

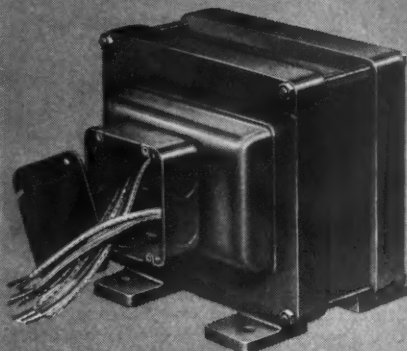


**CHICAGO TRANSFORMER**

Division of Essex Wire Corporation

3501 ADDISON STREET • CHICAGO 18, ILLINOIS

### PCB SERIES



Primaries  
230/460 or 575 Volts  
(50/60 Cycle)

Secondaries  
115 or 115/230 Volts  
½ to 10 KYA

## APPRAISING EXPOSED LAMP INSTALLATIONS

[FROM PAGE 53]

and cases on the walls. They want illumination that initiates a buying impulse and confirms it in the fleeting moments a customer's eye is ranging the shop. They want these particular effects along with lighting which creates an over-all feeling of brightness. The combination must say to customers outside and inside that the store is wide awake, really in business. These objectives are practical, economical possibilities with the careful use of exposed lamps for many small stores.

Many retail stores in the past, and many still today, with filament lamps in enclosing globes of opal glass achieved a degree of all over brightness which created that "in business" appearance. While the globes shielded the bright filament lamps from view their effect was generally a desirable pattern of stimulating brightness. They directed a considerable portion of their light horizontally to shelves and wall cases.

Shielding, with respect to filament lamps, obviously differs from that required for fluorescent lamps. Actually the brightness of most fluorescent lamps is of the same order of magnitude as opal enclosing globes with incandescent lamps. When used unshielded their brightness presents an installation problem analogous to enclosing globes. How they present themselves to the eye; whether they perform their illumination function so well as to interpose no distraction to selling depends, as it does with shielded equipment, on the appropriateness of the design.

Levels of illumination for stores in the small shop class are always rising, as might be expected in this competitive branch of business. That fluorescent systems are displacing filament systems is largely due to the consequences of the rising levels of store lighting. This same process also keeps the students of lighting in the merchandising business keenly interested in the possibilities of the simple, economical expedient of applying unshielded fluorescent systems to the selling of goods. This trend of interest is supported by the very fact of the rising levels of store illumination.

As the general levels go up, however, it is evident that we court trouble if we expect the higher levels



MEASURE  
GROUND  
RESISTANCE  
WITH



## VIBROGROUND

Self contained. Compact and portable. Direct reading in ohms. Simple push button operation. Measures resistance independently of auxiliary rod resistance. Unaffected by stray A.C. or D.C. potentials in ground area under test. Two models to meet all conditions. Model 255 for substation and ground mat testing. Four ranges, 0-3, 0-30, 0-300 and 0-3000 ohms; Model 251 for average conditions. Three ranges, 0-12.5, 0-125 and 0-1250 ohms.

Also available: "Vibrotest" insulation resistance tester—"Hypot" insulation breakdown tester—Cable fault locators—soil resistivity meters—limits bridges—ammeters—ohmmeters—current transformers.

*Write for bulletin No. 104*

**ASSOCIATED RESEARCH, Incorporated**  
"Precision Instruments since 1936"

221-K S. GREEN STREET

CHICAGO 7, ILLINOIS



**"The name is  
CHANNELLOCK"**



Choose the plier that meets your needs from our complete line.

Only these pliers incorporate the exclusive Channellock tongue and groove joint. This patented joint is far superior to the conventional type of adjustable pliers for these reasons:

1. Greater Strength.
2. Longer Wearing.
3. Closely Spaced Adjustments.
4. Self Cleaning.
5. Visible Adjustments.
6. No wear on Joint bolt.

Send for free catalog illustrating our complete line of Champion DeArment Channellock tools.



Channellock Pliers are specifically designed for:

Battery Work      Ignition Work  
Pump Repair      Electrical Repair  
                         Plumbing Work  
General Automotive, Electrical,  
Plumbing and Aviation Service  
work

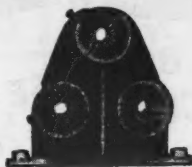
**CHAMPION DEARMENT TOOL CO.**  
MEADVILLE • PA.

Only  
Champion DeArment makes

**CHAN NEL LOCK**

## SIMPLICITY PLUS! New **NON-INDUCTIVE CABLE RACK**

for  
**INDUSTRIAL  
PLANT  
WIRING**



Type D-F 3-Conductor Cable Rack. New Non-Inductive Design. Racks available for cable sizes from 5/16 to 2 3/4"

● Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked Cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction... installation of cables made quick and easy through the use of split bushing.

Send today for Bulletin C-S-51 which illustrates the complete line

**THE M. & W. ELECTRIC  
MANUFACTURING CO., INC.**  
EAST PALESTINE, OHIO



## THE OHIO MOTOR CHARTING SERVICE

Our engineering department is capably staffed to make a survey of all motors and generators in your plant and to recommend the proper brushes to be used in each case and compile all technical data into book form for your references. It will be your guide to efficient operation and increased production.

IT'S ABSOLUTELY FREE OF CHARGE!

**THE OHIO CARBON COMPANY**  
12508 BEREA ROAD  
CLEVELAND 11 OHIO

*Easy—Fast—Neat*  
**SOLDERLESS  
WIRE CONNECTIONS**  
with **SOLAR  
SCRU-ITS**  
U.S. Patent No. 1,933,555

**MR. SCRUIT**  
(Trade Mark Reg.)

Solar SCRUITs are used for permanent wire connections or "roughing-in" without tape, solder, flame or tools. They form mechanically and electrically efficient joints and are easily removed when required. Speed up work, make wiring easier and better—with economical SCRUIT Wire Connectors.

### Easy-to-Use!

1. **STRIP ENDS!**
2. **SCREW IT!**
3. **THAT'S IT with SCRUITs!**

FOUR SIZES FOR JOINING SOLID and/or STRANDED WIRES

### 101 USES: HERE ARE A FEW...

- Fixtures
- Conduit Boxes
- Fuse Boxes
- Motor Connections
- Light Switch Boxes
- Lighting Devices
- Radio Equipment
- Transformers
- Circuit Breakers
- Switch Controls



*Write For...*  
**SAMPLES  
and  
SPECIFICATIONS**

**SEND DATA SHEET No. U-11 TO:**

Name.....  
Company.....  
Street.....  
City..... State.....  
Type of Business.....

**SOLAR ELECTRIC CORPORATION**

FACTORY and SALES OFFICES  
WARREN, PENNSYLVANIA



**BECAUSE THE  
CUTTING EDGE  
is  
KENNAMETAL**



**Kennadrills** have cutting tips of Kennametal cemented carbide—the metal that is far harder and more durable than tool steel. No starting punch needed—Kennametal tip takes hold readily, drills fast, retains sharp edge under heat and abrasion of cutting. Design assures clean, accurate drilling in all types of masonry. Can be used in any rotary electric drill. Available in sizes for drilling holes:  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ",  $\frac{7}{8}$ ",  $\frac{1}{1}$ ",  $\frac{1 1}{8}$ ",  $\frac{1 1}{4}$ " and  $1\frac{1}{2}$ ".

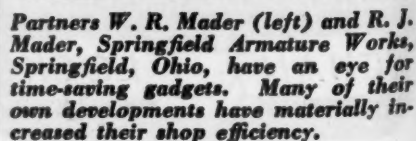
### ***Distributors Wanted***

**KENNAMETAL Inc., LATROBE, PA.**

## DRILL MASONRY FASTER, CHEAPER, EASIER

to make increases in the area or brightness of source more generally acceptable. While we may say that a source that would be uncomfortably bright in a room lighted to 10 footcandles may be comfortable in a room lighted to 100 footcandles, we must keep in mind that it takes a great deal larger area of light source to provide the 100 footcandles and this large area is often discomforting. Source brightnesses viewed in surroundings light in color or against a background of brightly lighted ceiling or wall are more comfortable than the same sources seen against dark backgrounds or dark surroundings, it is true. Always be sure whether or not such facts apply to genuinely extenuating cases for bare lamps.

Some of the exposed lamp installations which will be making the news will be in stores employing the slimline fluorescent type. The class of stores in which such installations will be made in the greatest number will be the retail chain units in drugs, groceries and certain variety shops. The brightness of slimline lamps at 120 ma. is only  $\frac{2}{3}$  that of a 40-watt lamp. The choice of slimline and other exposed lamp types for these outlets will be under the scrutiny of some of the nation's shrewdest business men. In the fields named competition is keen and, while continuous experimentation seeks methods for achieving lower operating costs, economies must be genuine. Exposed slimline fluorescent lamps, along with other fluorescent types, therefore, will be making case histories as to which of the quick turnover retail units provide the situation where they can help business. For anyone in doubt it should be remembered that there are effective methods for achieving desirable brightness without discomfort.



**—for every ventilating requirement in**

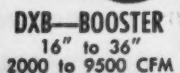
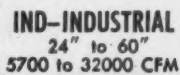
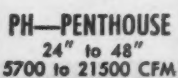
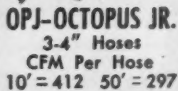
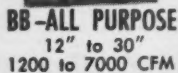


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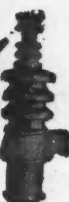
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## WHAT'S NEW IN SIGNALS

[FROM PAGE 59]

by 50 inches wide if individual indicators are used, and 18 inches high by 50 inches wide if only a common return buzzer and a drop or lamp signal is used. Whereas in a selective relay type system the central unit is 24 inches long by 20 inches high, and in a keyboard relay type system the central control unit is 12 inches long by 6 inches wide.

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A typical layout of a selective relay type system is shown in Figure 2. Illustrations of two types of calling units are shown as follows: the selective relay type system in Figure 3, and the keyboard relay type system in Figure 4.

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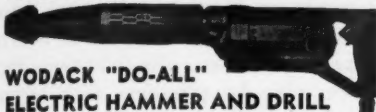
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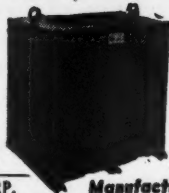
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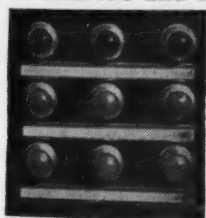
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## \* wiring worries

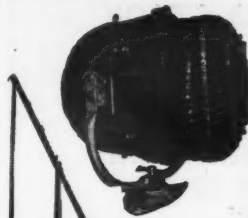
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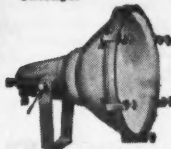
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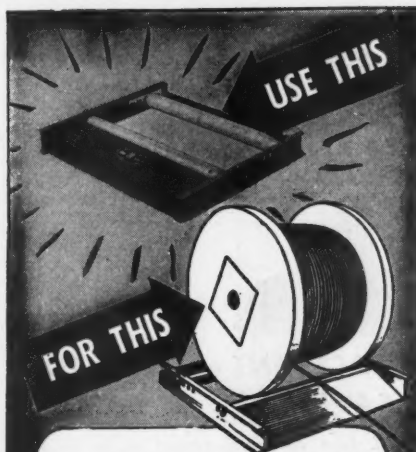


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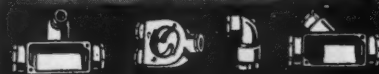
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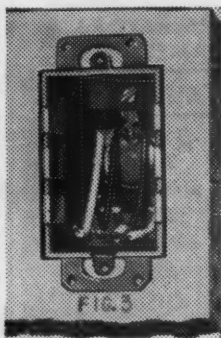


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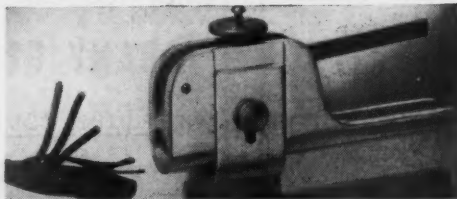
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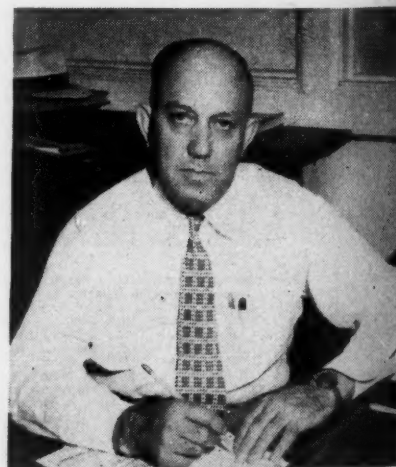
New York 18, New York

## BOSTON RED SOX LIGHT UP

[FROM PAGE 64]

neath the stands. A 2,000 kw. trans-  
former converts the voltage to 2400  
volts through metal-clad switch gear.  
Two outgoing 2400-volt circuits feed  
the seven towers. All steel conduits  
containing 2400 volt lines were encased  
in a concrete envelope to meet the  
Wire Department regulations of the  
City of Boston. The 2400-volt service  
was transformed at each tower to  
115/230-volts. Three transformers  
were used at each tower and the lights  
were grouped on separate feeders run-  
ning from the secondaries of each  
transformer. G. and W. oil fuse cut-  
outs were used to protect all tower  
transformers. Initial tests showed that  
the system required eight times the  
normal operating current or a total of  
16,000 k.w. for a period of about five  
seconds when the main breakers were  
thrown on to overcome lamp resistance.  
The entire system is electrically oper-  
ated by push-button control from three  
locations within the Park through the  
use of electric solenoid-type main cir-  
cuits breakers. Initial footcandle tests  
showed readings far in excess of the  
desired 200 maintained footcandles.

The installation was made during a  
period in which many types of material  
were difficult to get but nevertheless  
the system was in operation two weeks  
before the opening night game. The  
steel towers were furnished by the  
American Bridge Company and the  
majority of the electrical equipment  
was supplied by the General Electric  
Company.



Prominent in the electrical contract-  
ing industry is C. D. Hills, executive  
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